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RAILWAY-MOTOR IMPROVEMENTS.

Few pieces of electrical apparatus are subjected to the severity of service which is continually applied to railway motors. This type of equipment furnishes an excellent example of evolution in methods of design and manufacture during the past few years. Reliability of service has been the prime object of railway-motor designers, although the question of efficiency has not been neglected. Experience shows that the problem of mechanical design is essentially the most important controlling factor in successful railway-motor operation.

The advances which have been made are illustrated by the care now taken to secure proper insulation, commutation and lubrication in standard types of motors. Armature coils are wound with varnished cambric, constituting a high grade of oil-cloth, with a puncture test of 10,000 volts. In some motors ten thicknesses of this are put on, compared with only two thicknesses in old motor designs. On top of this is cotton taping, the whole being dipped in insulating compound. Mica is also used, cut in small pieces, about two or three mils thick, the strips being wrapped around each bar and the whole coil being put in a steam oven, which sets the mica to the bars, dissolving the sticking compound used so that the whole coil reforms itself into a solid mass. On top of this is applied an insulation of cotton tape. Such a motor can run to an actually higher temperature and do more work per pound of material than formerly, since a rise of temperature of seventy-five degrees centigrade above air at twenty-five degrees can be allowed, which is close to the boiling point.

Experience has shown that the life of insulation is from five to seven years, a considerable portion of the failures being due to cracks. If water gets in, carrying iron filings from the brake shoes, the insulation becomes injured, tending to create a burnout ultimately. Recent forms of motors are therefore specially designed to keep out carbon and iron dust. With oil instead of grease lubrication from six to eight times the old wear of bearings is being obtained. The grit in the grease used to limit the life of a bearing materially, whereas at present a run of from 60,000 to 80,000 miles without change is not uncommon. The equivalent of twenty trips across the United States without a bearing change is a triumph of modern design. In this connection the new process of roll-finishing bearings is important, giving a surface resembling polished silver in place of the gray color of a turned and filed shaft. The improved heat treatment of pinions and the adoption of a combination

of the split and box types of motor frames have also facilitated reliable and convenient operation. The undercutting of commutator mica and the adoption of interpoles, in larger sizes especially, have also tended to reduce the defects of these motors in service.

COLOR-PHOTOGRAPHY IN THE STUDY OF ARTIFICIAL ILLUMINATION.

During the convention last week of the National Electric Light Association at Atlantic City, N. J., a very interesting paper was presented by Paul F. Bauder dealing with "Quality of Light." In making an analysis of the color quality of several artificial illuminants in comparison with daylight illumination Mr. Bauder made ingenious use of the Ives colorimeter, and also of the trichromatic plates now being used in color-photography. While the comparative data secured in this way do not bring us to any close realization of artificial daylight with any of our present sources, they do indicate that it is essential to secure that light which is most adaptable for the work at hand. In other words, with the present sources of illumination it is not so much a question of securing artificial daylight as it is of using the proper light source from among those which we have available.

Dr. Charles P. Steinmetz in a brief discussion of this paper congratulated Mr. Bauder on his excellent work and suggested that this method might be used in a study of those luminous sources over which through our disposition of the light-giving mixtures we would have a greater control than we have with incandescent glowers.

The results so far obtained are not only interesting, but they appear to be trustworthy and they indicate lines along which further study can be made. It is to be hoped that Mr. Bauder will continue his work in this direction and that we will soon be able to add our commendation to everyone's applause.

LOCAL APPRECIATION OF HYDROELECTRIC DEVELOPMENTS.

In a recent issue of a Rockingham (N. C.) *Post* there was published a long appreciation of the value to the community of the development which is taking place under the direction of the Rockingham Power Company. This company has been through a series of vicissitudes, resulting in the foreclosure on the mortgage bonds and a receivership sale of the property, assets, franchises and effects to take place next month. It is presumed, and in fact announced, that after the sale takes place refinancing will occur quickly and the work of completing the plant will take place vigorously.

It is with the spirit of the article in the *Post* that we are immediately interested. This is so different from the customary attitude of mind which affects the natives that it is remarkable. It is unfortunate that in so many instances a power company is hampered in its development, and is treated by the locality it is intended to serve rather as supplicants for benefits and advantages instead of being treated as creators of benefits and advantages to the neighborhood.

PRIVATE POLICY.

Every once in a while some one gets up and says something original, or, if the statement be not entirely original an old saw is given new teeth and we are cut to the quick by being brought face to face with the fact that we have fallen short of doing our full duty toward our fellowmen. One of the breeziest and most interesting papers from a general standpoint presented at the recent convention of the National Electric Light Association at Atlantic City, N. J., was that of Paul Lüpke on "Private Policy." Mr. Lüpke's sentiment is almost entirely along the lines of using prudence and wisdom in the management of the private affairs of our corporate interests with a leaning toward giving the benefit of the doubt and the most generous treatment to those who apparently form the least important element in the organization.

To carry on the business a plant must be built and men must be hired to operate it. The sum and substance of private policy then should be to provide the right plant and hire the right men. After this, the station must be made as nearly as possible foolproof. There are two ways of doing this—one is to make the station apparatus proof against the fools, and the other is to eliminate the fools. Neither object can be secured entirely.

We must hire men as they are, but when we get them, we must do our level best to make them better as they go on with us. We must not be short-sighted and believe that if we give our men a fair show and a careful training that we will make them too valuable and that they will seek employment elsewhere. Even if they do so improve in whatever they are doing that they are fit for positions better than we have for them, we will at least have had their useful service during this formative period, and their presence in the organization will be a stimulus and an example to younger men who will stay with us longer, and to some of whom we may be able to offer such emolument as will make them stick.

All of the above is based upon Mr. Lüpke's suggestions and is a mixture of his sentiments and our own. We are glad that he has been able to present these suggestions to such a representative body as the National Electric Light Association, and it is a source of sincere congratulation to witness the spontaneity of accord with which these sentiments were received by those in power in our great institutions.

Work along the lines which Mr. Lüpke suggests cannot fail to produce good results. It is true that the higher we bring the plane upon which we establish our artisans and mechanics the higher the wage scale will go and the dimmer will become the line of demarcation between the trades and the professions. But we pay big money for the best machines, and when we discover how much more we can get out of our machines by having about us men who know how to operate them at their highest efficiency and keep them in the best possible condition we will be willing to pay big money for the men behind the machines, and it will not cost us so much more anyway. It is a matter of viewpoint in a large degree.

HIGH-PRESSURE GAS.

High-pressure gas has been adopted to some extent for street lighting in Europe, and is being offered for this purpose at Boston and other points in the United States. It has been claimed that gas at high pressure is more efficient than low-pressure gas for large interior lamps and for industrial heating purposes, and in London it is being applied on these lines.

Gas at high pressure of course contains no more heating power per pound than gas at low pressure, but the claim is that with the high-pressure gas a greater temperature and efficiency may be had at the incandescent mantle, and with industrial heating appliances. Thus while low-pressure gas, at flat-flame burners, may yield three or four candlepower per cubic foot per hour, under ideal conditions, and, say, fifteen candles per cubic foot per hour at mantle burners, the claim is that the high-pressure gas gives thirty to fifty candlepower per foot per hour at incandescent burners of special construction. It is not the purpose here to discuss the claims for an increase of efficiency with gas at more than the ordinary pressure, but merely to note its application in several cases and to point out some of the limiting conditions of its use.

The most important application of high-pressure gas to street lighting in London is that on Fleet Street and at the four corners of Ludgate Circus. On Fleet Street the use of high-pressure gas dates from Christmas, 1908, and thirty-six incandescent mantles that operated with gas at the ordinary pressure have been displaced by sixteen high-pressure inverted incandescent burners. At both Fleet Street and Ludgate Circus the lamps are of the same type and each has a nominal rating of 1,500 candlepower on twenty-five cubic feet of high-pressure gas per hour.

In Berlin, where the gas plant is owned by the city, high-pressure inverted lamps have been installed on some streets, and it is reported that 7,000,000 marks are to be expended, at the rate of 1,000,000 marks per year, to erect such lamps for most or all of the public lighting. The latest type of inverted high-pressure gas lamps in use on the Potsdamerstrasse and other important streets of Berlin have three burners each and consume sixty-five cubic feet of the compressed gas per hour. Early in the present year there were 2,163 street lamps using high-pressure gas in Berlin, and 725 of these lamps were of the upright and 1,438 of the inverted type. The upright high-pressure burners were rated at about 700 candlepower each, and 970 of the inverted burners were rated at an average of 800 candlepower, while the remaining 468 burners were supposed to yield about 1,600 candlepower each.

At several points in London, and particularly adjacent to Fleet Street, where a high-pressure main is maintained for the public lighting, private consumers are being supplied with the compressed gas for lamps and industrial heating appliances. On Bouverie Street, which crosses Fleet, the establishment where *Punch* is published is now supplied with the high-pressure gas for 350 inverted incandescent-mantle lamps, that are rated to consume two cubic feet of the gas per hour and to yield 100 candlepower each, and also for the drying presses and other heating devices. Another establishment supplied with gas from the high-pressure street mains is found at No. 111 Shoe Lane, and here sixty of the nominal 100-candlepower lamps, as well as heating appliances, are operated. Number 104 Fetter Lane has an installation of 215 of the so-called 100-candlepower high-pressure lamps, but in this case the gas is taken from the street main at ordinary pressure and passes through a compressing plant in the building before it reaches the lamps.

The above examples may serve to illustrate the extent to which high-pressure gas is being applied in Europe, and also some of the disadvantages and limitations attending its use for either public or private lighting. As the only claim for the superiority of the compressed gas over the ordinary kind is based on its supposed higher efficiency, it is well to note the cost that either the gas company or consumers must pay to make this higher efficiency available.

While the claims for the candlepower and gas consumption of the high-pressure lamps have been given as stated by the gas interests, because they are the more easily met when understood, it is not, of course, the intention to indorse these claims in any degree.

It appears that consumers are to derive no advantage from the fact that a cubic foot of the compressed gas has more weight and therefore a greater heating power than the same gas before compression, for the *Punch* office has to pay for thirteen per cent more gas than the meter registers to compensate for its loss of volume.

To compress the ordinary gas so it may be available at high-pressure lamps and heating appliances, there must be a compressing plant either at the works, along the line of mains, or at the premises of consumers. For the operation of high-pressure street lamps and their general supply for consumers it is necessary that the gas company distribute compressed gas through its mains, as only large consumers can be expected to install a special plant.

According to figures from the Berlin municipal gas works, the cost of compression there for the street lighting is 4.8 cents per thousand cubic feet, but it cannot be stated just what this cost includes or how much it would have to be increased to apply to conditions in the United States. Three compressing stations are operated by the gas company in Berlin for the high-pressure lighting, and two more stations of this sort are being added.

In London the street lamps on Fleet Street and Ludgate Circus are supplied by a high-pressure main, and a six-inch branch from this main was laid down Bouverie Street to the consumers there mentioned, but at No. 104 Fetter Lane the consumer is obliged to operate a compressor with a gas engine for his high-pressure lamps. Such a plant and the labor of operation must of course add much to the cost of lighting.

And as city streets are now generally laid with low-pressure gas mains, the addition of high-pressure mains is obviously an expensive duplication that consumers will be expected to pay for in one way or another.

National Electric Light Association.

Thirty-second Convention in Atlantic City, N. J., June 1, 2, 3 and 4, 1909.

Papers and Discussions. Parallel Sessions. Exhibition and Convention Notes.

TUESDAY MORNING SESSION.

The thirty-second convention of the National Electric Light Association was called to order at 10 o'clock Tuesday morning, June 1, in the Marine Hall, by President W. C. L. Eglin. After an address of welcome by Mayor Franklin P. Stoy, of Atlantic City, the president delivered his annual address.

As outlined in the complete report of the first day's proceedings, which appeared in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of June 5, the president's address was devoted principally to the broadening activities of the Association in its newly affiliated geographic and company sections. Mr. Eglin made a strong plea for the general affiliation of practically all the state associations with the national body. He showed that only good could come to all concerned from closer co-operation between all the organizations working for the welfare of the central-station industry. Standardization of practice is one of the things that can be brought about by such affiliation. The success of the company branches has been very marked in extending the influence of the Association to the mass of central-station employes. The Association's library has been growing rapidly and promises to be of much value.

After the appointment of a committee to consider the president's address, H. M. Edwards, chairman of the committee on a uniform system of accounting for electric lighting companies, presented this committee's report. In this report an extended comparison was made between the standard system of accounts adopted by the Association and that adopted by the Public Service Commission of New York. Detailed directions were given for charging to the proper accounts all items of expenditure for construction, operation, maintenance, etc. In presenting the report Mr. Edwards referred to the simple and yet complete system of accounts just published by the Railroad Commission of Wisconsin, which has been quite generally and enthusiastically adopted by the Wisconsin public utility companies. The discussion on this report was deferred to the accounting session of Thursday morning.

A review of the past year's work of the Question Box, prepared by its editor, Alexander J. Campbell, was then read by Secretary Gilchrist. Following this came a report from Dudley Farrand, the official representative of the Association on the National Conservation Commission. T. C. Martin then presented an abstract of his report for the committee on progress. The paper entitled "Private Policy," by Paul Lüpke, was read by Mr. Martin. The reading of this paper was greeted with prolonged applause. Extended abstracts of the papers and reports referred to in this paragraph were given in these columns last week.

An encouraging report was then submitted by the committee on state and company branches. The report was read by R. M. Searle, chairman. It showed the formation of three geographic sections and twenty-two company branches. The total membership in all these bodies was over 1,800. The geographic or state associations that have become affiliated with the National Association are the Pennsylvania, New England and New Hampshire sections. Among the company branches, that of the Commonwealth Edison Company, with nearly 500 members, is the largest. After reciting the advantages of membership in these various sections, the report was concluded with tentative drafts of constitutions proposed for state associations and for company sections.

FRANK W. FRUEAUFF.
President National Electric Light Association.

F. W. Frueauff was born in Columbia, Pa., March 29, 1874. In 1881 he moved with his parents to Leadville, Colo., and entered the employ of the Denver Consolidated Electric Company as meter reader and lamp clerk in 1891. He was elected secretary of the Denver Gas and Electric Company on its organization in 1899, and elected vice-president and general manager of the company in 1904. He is at present an officer in the following organizations: Vice-president and general manager Denver Gas and Electric Company; vice-president Pueblo (Colo.) Gas and Fuel Company; vice-president Lincoln (Neb.) Gas and Electric Lighting Company; vice-president Lebanon (Pa.) Gas and Fuel Company; treasurer Summit County (Colo.) Power Company; secretary Lacombe Electric Company; director Massillon (O.) Electric and Gas Company. He is president of the National Electric Light Association, past-president of the National Commercial Gas Association, a partner of H. L. Doherty & Co. and a member of the American Gas Institute, Colorado Light, Power and Railway Association, Lawyers' Club, New York; Denver Club, Denver; Denver Athletic Club, Denver Country Club, Overland Country Club, the Sons of Jove, El Jebel Shrine.

A spirited discussion of the subject was begun by C. L. Edgar of Boston, who thought that more was to be gained by having the men of any company meet those of other companies in the same state or district than to rub up against each other, which they already do in company clubs and similar organizations. He believed, therefore, that more energy should be expended in pushing the state organizations.

L. H. Conklin, president of the Pennsylvania State Electric Association, indorsed what had been said as to the greater importance of the state associations; in fact, few could estimate the great value to the members of these associations of affiliation with the national body, but, on the other hand, the company branches had also a distinct mission to perform and they were doing it well.

S. F. Smith, formerly president of the Association of Electric Lighting Engineers of New England, told how that organization had dissolved itself into the New England section of the National Electric Light Association. Not all the old members could join the reorganized association. There were some municipal plant engineers for whom provision has not yet, but should be, made. In many ways these men can help the private plants politically by making recommendations which, if made by the companies, might create popular suspicion of ulterior motives.

Others that discussed the subject were: H. W. Hillman, Dudley Farrand, D. B. Rushmore, C. N. Stannard, M. S. Seelman, Jr., B. W. Mendenhall, H. Almert, H. Goodwin, Jr., R. M. Searle, E. F. McCabe, E. L. Smith and John F. Gilchrist. None of the speakers deprecated the organization of state associations, and most of them spoke as well of the value of the company branch, the aim of which is to interest the men from the bottom up in the general methods and policy of central-station work.

TUESDAY EVENING SESSION.

At 8:30 p. m. the second general session of the convention was opened by the reading of several amendments to the constitution of the Association that were submitted by W. W. Freeman. A motion to refer these to a committee was carried.

The committee appointed on this matter was the same that had been selected to pass on the recommendations of the president's address. It consisted of H. L. Doherty, C. L. Edgar and W. W. Freeman. Its report was submitted at the Friday executive session.

A paper on the "Latest Developments in Street and Park Lighting" was presented by J. W. Cowles of Boston. After a short discussion of it by S. G. Rhodes, the report of the lamp committee was submitted by W. W. Freeman, its chairman. At its close P. S. Millar described a series of tests of foreign-made tungsten lamps that is now in progress. The results so far seem to indicate that the American lamps were seventy-five per cent better than the foreign ones.

The discussion of the lamp committee's report was participated in by F. W. Willcox, J. W. Cowles, C. L. Edgar, M. S. Seelman, Jr., Farley Osgood and Mr. Freeman.

S. E. Doane of Cleveland then presented an abstract of his paper on "Methods of Manufacture of Incandescent Lamps." Following this Paul F. Bauder delivered an illustrated address on "Quality of Light." All the papers presented at this session were abstracted in the report given last week.

The discussion on Mr. Cowles' paper was resumed by Farley Osgood, who said that the use of flaming-arc lamps in front of a store necessitates the installation of increased illumination within to avoid the sharp contrast between the exterior and interior. Dr. Charles P. Steinmetz closed the discussion of the evening by referring to the control of the color of light that we now have through the impregnation of flaming-arc electrodes.

WEDNESDAY MORNING SESSION.

The paper entitled "Advance Information Regarding Developments in Storage Batteries" was read by Joseph Appleton, of the Electric Storage Battery Company.

The most important development in this line, as far as central-station interests are concerned, is the development of the Exide battery in large sizes for power plant and substation use. This new type of battery has a very much greater capacity for substantially the same space required and for a very slight increase in weight than the type of battery in most common use for these purposes at present. With an increase of only fifteen per cent in the weight the output of these new batteries is from two to four times that of the older ones. The terminal voltage is also higher and the length of time for which the battery can be discharged at high rates is increased. There have also been perfected improvements in end-cell switches particularly adapted to this new form of battery. The use of storage batteries in connection with the exciter system of large turbo-alternators was described. This use is increasing and has been found very serviceable. The author also dwelt upon the use of storage batteries by large consumers in order to carry peaks of short duration, so as to improve the load factor and thereby reduce the maximum demand. One of the latest developments in battery regulation was that at the great steel works at Gary, Ind., which the author described in some detail. The storage battery here is used to regulate the load on both the direct-current and alternating-current systems. The use of the mercury-arc rectifier has enabled storage batteries to be employed very successfully in isolated plants of moderate capacity, thereby enabling the battery to be charged properly with comparatively little attention.

There being no discussion, the paper entitled "The Regenerative Flame Lamp" was read by A. J. Mitchell, of the Adams-Bagnall Electric Company.

After tracing the prevailing tendencies in the development of flaming arc lamps Mr. Mitchel showed that the first notable type making use of vertical carbons was that developed by Blondel. This made use of a mineralized carbon positive for the lower electrode and a negative pencil of nearly pure carbon for the upper electrode. It had the objection, however, of comparatively short life of the carbons. The Regenerative lamp makes use of a similar arrangement, but the positive electrode has a center of pure carbon with fluted radial extensions. The spaces between the ridges is filled to the outer edge with the light-giving salts, mostly compounds of calcium and fluorine. The diameter of the carbon is about 0.875 inch. The second distinctive feature of this lamp is that it retains the efflorescence of the carbons. The gases pass into an upper chamber above the inner globe, and from there through side tubes or conductors to the bottom of the globe. In their passage through these tubes the temperature of the gases is decidedly lowered so that the less volatile elements settle on the side of the walls, while the lighter gases return into the arc chamber and again mix with the upward draft passing through the arc. By this circulation of the inflammable gases a very steady and highly efficient arc is constantly maintained. The intrinsic brilliancy is enhanced and a better distribution is secured by the unusual length of the arc. The Regenerative lamp approaches the carbon arc in distribution and also in size of unit, being almost equivalent in current consumption to the 450-watt carbon lamp, but having a ratio of luminous efficiency of about five to one in favor of the new lamp. The mean hemispherical candlepower of this lamp has been calculated as 1,340 or 0.26 watt per candle. This is for the lamp equipped with an opalescent globe. The lamp seems to be peculiarly suited for street lighting. The author gave many comparative data to show the advantages of this lamp as regards economy of operation. He closed his paper with a more detailed description of its construction and operation.

The second paper on arc lamps, entitled "The Present Status of the Arc Lamp for Street and Interior Illumination," by N. R. Birge, of the General Electric Company, was read by C. W. Stone.

At the opening of his paper the author referred to the development of the 6.6-ampere luminous-arc lamp for series service, and he compared it with the four-ampere lamp of this type, as well as the 6.6-ampere open and enclosed arcs. He described a form of alternating-current series luminous-arc lamp making use of titanium carbide as the light-giving electrode, and compared this form of lamp with the direct-current luminous-arc lamp already referred to. In this comparison the elimination of the rectifier was more than counterbalanced by the added expense of the titanium electrodes. After alluding to the development of the flaming-arc lamp Mr. Birge described an improvement of the direct-current enclosed lamp. This form of lamp is known as the "intensified arc." Another type of arc lamp recently developed is one embodying the same desirable characteristics as the intensified arc but built in very small size and adapted to the use of various globes and reflectors for changing its distribution of light.

The third and last in the series of papers on arc lamps, entitled "Recent Types of Arc Lamps and Their Operation," was read by C. E. Stephens, of the Westinghouse Electric and Manufacturing Company.

The author of this paper compared the illumination curves obtained from the direct-current open arc, alternating-current open arc, and the direct-current enclosed arc to show the characteristics of each of these lamps and their shortcomings in many ways. The development of the flaming-arc lamp was touched on, and then the characteristics and construction of the Westinghouse metallic luminous-arc lamp were described in detail. This lamp was declared to be particularly suitable for street lighting and the illumination of large areas, on account of the broad and quite uniform illumination obtained from it. After describing its method of installation on various series systems, a comparison was made of the relative advantages of this lamp with those of other types. The general conclusion was that the luminous-arc lamp has the greatest future for general outdoor illumination, and is the one best adapted for use of central-stations for street lighting, since it enables the supply of more light for the same money or the supply of the same light for less money.

Dr. C. P. Steinmetz, in opening the discussion, said that the first paper on the regenerative flame lamp shows a very interesting form of this lamp, which has the advantage over the flame lamp as used so extensively abroad that it gives a much longer life of carbon. This form of lamp is not exactly new, because he recalled building several of these lamps as early as 1902. However, this form of regenerative flame lamp, the circulating flame lamp, as it used to be called, has not made any great headway against the luminous arc, the magnetite lamp, which originated at about the same time.

While the yellow color is very nice to give a glare of light, it is not suited for general illumination, especially in American cities, where the citizens usually take some pride in having trees and well-kept lawns, etc., which look dead in the yellow light. Therefore we always prefer white light. White flame carbons have not been available heretofore, at least not white flame carbons which had any efficiency worth speaking of. It is to be hoped, and there are good prospects, that we may get available for commercial service highly efficient white flame carbons, of efficiencies fully equal to those of the yellow flame carbon, so that would eliminate the first handicap the lamp has. Regarding the second one, the cost of electrodes, judging from the statements given in the paper, of seventy hours' light and fifty cents per trim, that gives the cost of electrodes about twenty times as high as the magnetite lamp, which obviously is altogether too high. However, there does not appear to

him any particular reason why it should be so. There are two or three interesting points which are not generally appreciated regarding these highly efficient modern lamps. The first one is the effect of enclosing globes. In the case of these high intrinsic brilliancies of the flame arc, or magnetite arc, where we deal with larger units, as 6.6-ampere lamps, we must have some method of reducing the brilliancy of the light; that is, some diffusing or refracting globes. It is not generally realized that the opal globe and frosted globe, sand-blasted or etched, are not equivalent, but give an entirely different effect. The frosted globe scatters the beam of light slightly and breaks it up into an angle, and so smooths out the distribution curves, but leaves it essentially in character the same, so that a lamp which gives a maximum intensity under forty-five degrees with the vertical, like the open arc, still gives with the frosted globe the same distribution curve, only the sharp, abrupt changes are slightly reduced. The opal globe, however, acts entirely differently. It acts as a secondary radiator; that is, the light does not come any more from the arc, it comes from the globe and the distribution curve, therefore is that which would be given by the globe as the illuminant, and hence depends on the shape of the globe, which is not the case with the ground-glass globe. The second feature is the relation in efficiency between the alternating-current arc and the direct-current arc. We know that the direct-current enclosed carbon arc is very much more efficient than the alternating-current enclosed-carbon arc. The plain carbon arc is really an incandescent lamp; that is, the light is given by the incandescence of the tips of the carbons. In the direct-current lamp all the heat practically is concentrated at the positive carbon. That, therefore, gets very much hotter and therefore radiates light at a much higher efficiency than is the case in the alternating-current lamp, where the heat is uniformly distributed between the two electrodes. Hence, the alternating-current arc is less efficient than the direct-current arc. When you come, however, to the flame lamp, in this only a small part of the light is given by the carbon tips by incandescence, almost all coming from the flame, and in the luminous or magnetite arc, no light is given by the terminal, but by the flame. In the arc flame the light is given by the passage of the current through the electrode vapor, and it is obviously entirely immaterial whether the current passes through the vapor in one direction or another; that is to say, the arc flame has the same efficiency with alternating current as with the direct current, and therefore in the flame carbon the difference in efficiency between alternating current and direct current has almost disappeared, and has entirely disappeared in the luminous arc, as the magnetite and titanium carbide arcs. That is interesting to realize, because the inefficiency of the alternating lamp has been a rather severe handicap, but it is encouraging to know that this ceases to exist with the modern high-efficiency lamps, and that you can run them for their developed rating with alternating currents without sacrificing efficiency for convenience of operation, as was the case with the enclosed carbon arc.

J. W. Cowles said that in connection with a new street-lighting contract in the city of Boston the Edison Company recently had occasion to meet fairly and squarely the general demand for more light. In fact, the company has been an ardent advocate of this call and is in no small degree responsible for the demand. It was realized early in the negotiations that probably nothing short of some form of the modern arc, the newer arcs, either of the flaming or luminous type, could be expected to meet the requirements. Consequently a careful investigation was undertaken of the various types of lamps which seemed to give promise of meeting the requirements, both of foreign and American manufacture. A very careful study was made and very interesting results obtained. To make a long story short, it was found that, all things considered, the luminous arc as produced by American manufacturers offered by all means the best and most satisfactory results. In the case of the four-ampere magnetite lamp, the few minor complications or difficulties which were encountered in connection with operating the lamps at 6.6 amperes were very quickly and very satisfactorily solved. It was the urgent desire from the start, if possible, to maintain the present generating and distributing systems, and a lamp suitable to operate satisfactorily over standard 6.6-ampere series circuits was urgently sought. The lamps as now being installed on the 6.6 circuits are promising most excellent results. On the highest poles, and with the opal globes, an illumination both as to volume and as to distribution is being obtained which is exceedingly satisfactory—actual candlepower measurements show these lamps to be easily two to three times the equivalent of the lamps formerly in use.

The report of the committee on meters was read by G. R. Greene, Philadelphia, chairman.

The meter committee has endeavored this year to present a report which is in the nature of a foundation, and has included in it as much general information and as many educational features of an elementary character as circumstances permitted.

The report consists of, first, the report proper, and the table of contents indicates the subjects touched upon; second, Appendix No. 1, which covers in an elementary manner the underlying principles of meters and an outline of laboratory tests; third, Appendix No. 2, which is an exact compilation and tabulation of the answers received in reply to the questions submitted by the meter committee to each of the Class A members last October, and, fourth, Appendix No. 3, which is a copy of twelve letters received in reply to a request for information on "Meters vs. Flat Rate."

The committee feels that, in this report, it has done little more than scratch the surface, and leaves to future committees the task of delving deeper into the subject.

The committee called attention to the absolute necessity of maintaining the accuracy of meters; and this can be secured only by purchasing the best grades of meters, replacing old and inferior makes by modern types, adopting proper methods of installation, and by systematic testing and inspecting.

The committee desired especially to bring to the notice of the members its exhibit in the exhibition hall. This exhibit was not intended as a mere display of meters, instruments and equipment. Much of the apparatus was not, in a measure, on exhibition at all and was intended and utilized principally and almost exclusively for the sole purpose of demonstrating meter practice.

The committee expressed its thanks to all of the companies which loaned apparatus for the exhibit, to all of the companies which answered the questions propounded, and especially to Burleigh Currier of Philadelphia, who prepared the Index No. 1, with the assistance of J. D. Seaman of Philadelphia, who also worked on it; to William Le Roy Robertson of Philadelphia, who compiled Index No. 2, and to P. H. Bartlett of Philadelphia.

W. Eichert, Brooklyn, said that there was a question in his mind whether it is necessary to make an installation test on all meters. The method in Brooklyn is to make such a test on direct-current meters over 100 amperes and above, and on the large polyphase meters. The inspector in Brooklyn checks the wiring of the meter, examines carefully all the meter parts, turns on the installation, or part of it, the wattage of which is known approximately, and then times the disk of the meter with a stop watch and in that way obtains the approximate accuracy of the meter. If the meter has not been damaged during transportation, the only errors that can be seen are the ones caused by the seasoning of the commutators on direct-current meters and that of changed conditions. It has been found that this error does not exceed two per cent on an average load, and sometimes much lower than that, and probably also in some cases none at all.

Samuel Insull, Chicago, said the meter committee should give a good deal of attention during the next year to the subject of the cost of meters. It is a very serious thing to the member companies, especially in connection with the use of high-efficiency lamps.

The paper entitled "Future Requirements of Central Station Companies" was read by P. Torchio, New York.

Mr. Torchio pointed out that the average yearly load factor of all the central sta-

tions in this country is only twenty-three per cent. In his company, for example, ninety-seven per cent of the total electrical output is produced by fifty per cent of the generating equipment, whereas the remaining three per cent of the output, representing peak loads, requires the remaining half of the equipment. Bearing this in mind, it seems that a central-station company would obtain the greatest economy by having half of its generating apparatus of the greatest possible efficiency and the other half of the cheapest possible kind and practically regardless of its operating efficiency. This may mean the operation of composite equipments, consisting of hydraulic turbines, gas engines, steam turbines and steam engines. In pointing out the more important requirements of the future, Mr. Torchio declared that the steam turbine will become the standard steam apparatus even for smaller companies. Larger units than 15,000 kilowatts are doubtful. There is a demand for a direct-current turbo-generator of 1,000 or 2,000 kilowatts capacity, but it must be reliable and efficient. For increasing the capacity of present engine plants the low-pressure turbine is the readiest and cheapest means. Gas engines are bound to come to the front. Combined gas and electric plants operate most economically when they have gas-engine units utilizing the gas made instead of having a separate steam-engine equipment. Among other points touched on by the author were the installation of rotary converters of 3,750-kilowatt maximum capacity, the development of new central-station storage batteries of greatly increased emergency discharge capacity, cheaper wiring of old buildings, electric refrigeration, and the further exploitation of electric vehicles.

The paper entitled "Some Recent Developments in Electrical Apparatus," by E. W. Allen, of the General Electric Company, was read by C. W. Stone.

This paper reviewed the advances made in the line of generating, converting, controlling and protective apparatus during the past year. The most marked advance in generator design has been the building of high-speed turbo-generators of very large capacity. The construction of the 14,000-kilowatt generators, which is the largest size as yet attained, was described. The most troublesome feature about their design is proper provision for cooling them. On account of their extremely compact build it is necessary to entirely enclose these machines and to construct the rotor so that it acts like a powerful fan and forces an abundance of cool air through the cores and windings of the machine. In direct-current generators development in the line of high speeds of rotation has been marked. This has necessitated the provision of special steel rings shrunk over the commutator. The adoption of auxiliary commutating poles has tended to solve the problem of commutation. The design of belt-driven generators has undergone considerable change toward making them interchangeable as motor and generator, and for making them readily into open, partially or totally enclosed machines. They can be mounted on the floor, wall, or ceiling by slight changes in the position of the end shields that support the bearings. A marked improvement in the efficiency of these machines at fractional loads has occurred. Rotary converters have been developed by the provision of regulating poles between the main poles. The split-pole type of machine is capable of maintaining constant direct-current voltage with wide variations in the potential of the alternating-current supply, and it can also maintain a constant load so as to cause storage batteries or other machines to take care of its fluctuations. This is advantageous when power is furnished from a transmission line, and the rate of charge is based on the maximum demand. The construction of vertical-shaft rotaries has continued, and they are now built in sizes up to 2,500 kilowatts. No very general changes in the design of frequency-changer sets have occurred except that the capacity of vertical-shaft machines has been increased, and there is now being built for the Commonwealth Edison Company a machine of this type having a capacity of 5,000 kilowatts. In the construction of transformers the matter of cooling in the large sizes has become very much more important. For the largest sizes now built the cooling is carried out by circulating both the oil and the cooling water. Control apparatus is developing more and more in the line of remote electrical control. The opening and closing of switches is accomplished in three different ways, either by means of a motor, a plunger and solenoid, or by means of the piston of an air cylinder controlled by suitable valves. The use of remote-control devices enables the engineer to place the switch and busbars of high-potential systems in fireproof compartments located without regard to the controlling board, and it brings their control under the direct supervision of a single operator. Protective apparatus has received the most striking advance through the development of the aluminum-cell lightning arrester. Exhaustive tests of this form of arrester have been in progress on some lines subject to very severe lightning disturbances, and they have in general proven highly satisfactory for this purpose.

The paper entitled "Distributing Transformers as of Interest to Central Stations" was read by E. G. Reed, of the Westinghouse Electric and Manufacturing Company.

The author opened his paper with a historical review of transformer construction. He showed the developments that have taken place in the design, and dwelt at some length upon the latest form of shell-type transformer, in which the iron core is subdivided into four sections, forming a crossed construction. The subjects of copper and iron losses, exciting current, and of regulation of transformers were treated at some length. The importance of low exciting current was emphasized as affecting the all-day efficiency to a high degree. The mechanical assembling of distributing transformers was then taken up, and methods of mounting transformers in the case of installing them upon poles and in manholes were described. After discussing the proper methods of testing transformers the author considered their operating characteristics. Considerable attention was given to the subject of heating of transformer cores and windings and of proper methods for dissipating the heat developed. Precautions to be observed in the parallel connection of transformers were brought out. The paper closed with a brief allusion to the future developments in transformer design that are to be looked for. The most desired features in this line are higher permeability and lower losses; also improvement in the insulation so that it requires less space is also highly desirable.

W. S. Moody, Schenectady, said that in 1904 the General Electric Company undertook to make an unusually exhaustive study to see how much nearer the ideal form of transformer it would be practicable for us to get without sacrificing reliability and simplicity of manufacture. Several of the best engineers devoted months of study to the subject and finally developed a form of core and windings that, as generally known, is in very close agreement with the transformer which Mr. Reed had described. The commercial introduction of this transformer was delayed for some time for two reasons—first, when patents were applied for for some of the constructions that had been developed, it was found that Mr. Barry, whose work Mr. Reed's paper mentions, covered some of the more important features of the core, and the negotiations through which these patents were finally acquired consumed considerable time. Again, the new silicon steel became available about that time, which also made some delay in modifying the design to take full advantage of it. What he wanted to point out particularly was the fact that two entirely independent bodies of investigators should arrive at so nearly the same solution of their problem is a pretty good indication that until we have some radically new constants in our iron or radically new materials to deal with, that it would seem we must have arrived at pretty nearly the ideal thing to have reached the same conclusions so closely at the same time independently.

M. A. Sammett, Montreal, said that up to the present time the question of exciting current was seldom paid attention to, but the regard for the excessive iron saturation, as held by manufacturing companies, brings up the question of exciting current and makes it important. He had occasion to report on three transformers of about 100 kilowatts capacity, 2,200 volts, thirty-six cycles, and in testing these he found that the exciting current at normal voltage and normal frequency was about 12.5 per cent of the full-load current. That was extended to such a point as to make the exciting current prohibitive. The transformers are supposed to operate at ten per cent voltage in excess of normal voltage. At 2,420 volts he has found the exciting current was nineteen per cent of the full-load current. While the new high-efficiency alloy steel is of great benefit to both the manufacturing companies and the operating companies, from the standpoint that it permits of transformers of lower core losses and higher efficiencies, they should never force the magnetization to such a point as to disregard the question of the exciting current. It is important to the operating companies from the standpoint of limited generating capacity and fractional load, as well as having a very detrimental effect on the regulation of their system.

WEDNESDAY EVENING SESSION.

The Wednesday evening session was opened with the reading of the report of the secretary and treasurer, John F. Gilchrist, Chicago, Ill. The total receipts for the year were $41,271.48, leaving a balance on January 1, 1909, of $9,500.44. The cash on hand May 1, 1909, was $24,-023.16.

Some progress has been made in the formation of geographical and company sections, provisions for which were made in amendments to the constitution last year. A larger co-operation on the part of the membership is needed to develop this feature of the Association work to the condition to which it is hoped it will attain in a short time. Since January 1, 1908, the membership has been increased over 120 per cent. The membership at present is as follows: Class A, 728; Class B, 2,152; Class D, 203; Class E, 132; a total of 3,215. Three new important standing committees have been created by the president—a lamp committee, a finance committee and a library committee. Through the courtesy of the Co-operative Electrical Association and Arthur Williams and his staff, the material submitted last year in the prize competition has been edited and published for issuance as a solicitor's handbook. The secretary's report closed with a warm endorsement of the efficient work of Miss Billings, the assistant secretary, and her assistants, and an expression of thanks to the officers and members for the great amount of assistance rendered the secretary's office during the year.

Frank A. Vanderlip, president of the First National Bank of New York, delivered an address on the subject of "Electrical Securities." Mr. Vanderlip said that when we note that the total investment in electric-light plants has now passed well beyond the billion-dollar mark, and remember that five years ago there were some 4,000 companies, with a total investment of perhaps $700,000,000, the statement is surprising. The clearness with which the public has come to recognize that its rights are best safeguarded by granting monopoly privileges and then subjecting the monopoly to reasonable regulation is the safeguard which the investor appreciates. Mr. Vanderlip thought that we were entering upon an era in which investors will look with increasing favor upon electrical securities, and in which the funds available for electrical development will be obtainable with much greater ease and at much lower rates than have ruled heretofore. The utilization of great waterpowers which are now being so rapidly developed will tend toward a combined management covering large areas. The progress which is being made in long-distance transmission is of the greatest importance in this direction. The tendency of the times is distinctly in the direction of recognizing the natural monopolistic character of the electric lighting business.

An address was then made by George S. Graham, of Philadelphia, on the subject of "The Electrical Industry."

Thomas N. McCarter, president of the Public Service Corporation of New Jersey, said that the greatest problem that the members of the Association and the companies that they represent have to solve is not of a technical nature, but is in large measure one of financing. The fact today is that future improvements must be capitalized and renewals must not be capitalized.

C. A. Coffin, president of the General Electric Company, said that the central-station industry had accomplished a wonderful work. When this work has in its ultimate analysis so attracted conservative investors that a four per cent security is selling above par and a five per cent bond is at a premium, it certainly indicates that the security markets of the world are open to the industry.

Samuel Insull, president of the Commonwealth Edison Company, spoke as follows:

"There are a number of us in the larger cities who have been trying to carry out the scheme of centralization of production, which is so necessary in order to get a satisfactory volume of securities, and those of you here who, like myself, have been for the last ten years placing larger and larger volumes of securities have found it easier and easier to dispose of these securities.

"Now, most of our members here come from the smaller companies, and it is a very natural thing for them to say that it is very difficult for them to do in Squeedunk what you are able to do in New York, Newark, Philadelphia, Boston or Chicago. But the fact is, if you will profit by the advice Mr. Vanderlip has given tonight, it is within your power to work in the direction of centralization, which is so necessary in order to get economic results. There are many of you in this room who represent plants within a distance of one another of, say, anywhere from ten to thirty miles, which, if you would unite, get together in a smaller way, duplicating what we have been able to do in the larger cities, you would find beneficial financial results, and if you want your securities sold with ease, if you want to get a high price for them, which means low interest rates, you have got to consolidate your properties.

"I remember some five years ago paying a visit to my old friend, Mr. Rathenau of Berlin, who is looked upon as the electrical emperor of Germany. I asked him what he thought would be the next development of the electric-light and power industry, and his reply was, "Concentration of areas of distribution." I asked what he called an area of distribution. He said there is no reason why there should be more than one distributing system within an area of fifty miles. Now, if that is possible in the countries of Europe, where the people are slower to take up a new industry, surely in this country, where we have such rapid progress in every industrial development, it ought to be possible here. If you will bear in mind, we are engaged in a business that turns its capital once in five years at the very best, you will see at once how necessary it is to find a proper market for your securities, as for every $20,000 of new business you get, the least possible capital investment is $100,000.

"I am heartily in sympathy with what Mr. Vanderlip has said with reference to the question of depreciation and its effect on the stability of the enterprise—if we are careful to charge to our expense account what is really expense and retain in some form a depreciation account which will take care of the apparatus which has to be thrown away, we will have less difficulty. This is a subject we have often discussed here, and one which I believe during this week we expect to give a great deal of attention to."

A motion of thanks was tendered to Mr. Vanderlip and Mr. Graham.

Everett W. Burdett, of Boston, related some reminiscences of the earlier days in the electric-lighting industry, and made a very pleasing reference to early conditions in Boston.

The report of the committee on public policy was presented by Mr. Insull, chairman. At the conclusion of the report Mr. Insull said:

"The only other subject that would seem to be of interest to our members, but which the committee thought it better not to mention in the report, is the signs that are becoming somewhat apparent in different parts of the country, of a tendency on the part of some of the electric manufacturing companies to raid the securities of our member companies by fostering the formation of opposition electric illuminating and power companies. I do not care whether the excuse is made that it is an effort to sell their apparatus, or whether you call it by the term that I have used, "raiding our securities," or whether you pick out an uglier name which I will not mention, the fact remains that those who have been in this business for a number of years look with great alarm at any tendency of the manufacturing companies in that direction.

"I first asked the president to consider the public-policy report in executive session, but during the speech delivered by Mr. Graham I told him that if he agreed with me I would prefer that it should be considered in public session. My object in suggesting that was that necessarily there are representatives of the manufacturers present, and I want them to hear what I have to say. The worst thing that they can possibly do is to start in and try to 'kill the goose that lays the golden egg,' and we happen to be the goose. It has been stated here tonight, on good authority, that we have invested in our business a billion of dollars. I presume it would be fair to state that there is hardly as much as a little more than one-third of that amount invested in the electric manufacturing business of the country.

"Now if the investors of that $300,000,000 want to pull the house down over their heads, the best way, and the quickest way for them to do it is to pursue a policy in selling their goods which will throw discredit on the billion dollars invested in our side of the business. I am speaking whereof I know. I understand that there is a well-defined plan to start

this campaign as it used to be carried on twenty or twenty-five years ago in the smaller communities of the country, but they are after larger game. The excuse made is—'we do it because we cannot sell our goods anv other way.' We have had fortunately very little of that kind of thing to deal with lately in the public-policy committee. It was a well-defined policy of certain of the electric manufacturing companies fifteen or twenty years ago. Many of us know that to our cost. I think that it is only fair that as an organization we should serve notice on some of the gentlemen who are responsible for the operation of several of the large electrical manufacturing companies, and who have not the benefit of the experience of ten or fifteen years ago, that such a course, while it might temporarily affect the values of our securities, must inevitably react on the manufacturing companies starting it, and must array against them, whether by organized effort or by spontaneous action, a thousand millions of capital invested in the electric illuminating business in this country.

"I had intended to ask tonight to be relieved of any further connection with the public policy committee, but with the possibility of such a movement coming to a head, I hope that I will have the privilege of serving this association in some capacity in connection with the public-policy work during the ensuing year."

There was no further discussion and the meeting adjourned to executive session.

THURSDAY MORNING—FIRST COMMERCIAL SESSION.

The paper entitled "Methods of Introducing Tungsten Lamps and Their Effect on Central-Station Income," was read by Wm. H. Atkins, Boston.

Mr. Atkins, assisted by the following assistant editors: R. F. Bonsall, J. S. Cartwright, W. H. Chase, A. A. Dion, J. W. Hancock, O. R. Hogue, Joseph D. Isreal, George B. Johnson, George H. Jones, E. A. Mills, C. F. Oehlmann, M. C. Osborne and R. W. Rollins, submitted what proved to be a very exhaustive and instructive paper. After a brief introduction Mr. Atkins indicated (a) the different policies adopted; (b) the methods of introduction and renewals; (c) use of large units in competition with gas arcs; (d) their effect on incomes. This résumé of the different policies adopted was derived from an analysis of the answers given to certain questions put to different companies. For the purpose of carrying out as fully as possible the object of the paper forty questions were placed very generally before companies throughout the United States and Canada that are introducing the tungsten lamp. Answers to twenty-eight of the questions were tabulated. The information obtained represented companies with a connected incandescent lamp load of about ten million carbon lamps and about five hundred thousand tungsten lamps. Mr. Atkins gave it as the opinion of the Boston Edison Company that it would have a very large increase in business as the ultimate result of its adoption of the tungsten lamp. Specimens of the newspaper advertisements of this company as relating to their tungsten-lamp orders were given, halftones showing the old-style lighting with carbon lamps, a photograph of eight-minute exposure, and of the new-style lighting with tungsten lamp, a photograph of three-minute exposure. The representatives of the Commonwealth Edison Company supplied instructive and interesting particulars of their company's experiences with the tungsten lamp in Chicago. Application forms of the company with schedule of prices for tungsten clusters formed exhibits to the paper, and some illustrations of their successful installations were given. Conditions in Philadelphia, Pa., Hartford, Conn., Ottawa, Ont., Baltimore, Md., Dayton, Ohio, Spokane, Wash., Richmond, Va,. and Montpelier, Vt., were also described by the respective assistant editors.

M. S. Seelman, Brooklyn, in opening the discussion, said that something over a year ago the Brooklyn Edison Company had begun notifying all customers that the tungsten lamp had arrived, detailing its features and purposes and notifying them that they were available in limited quantities. This company wished to get out among non-consumers of current with the tungsten lamp, and secure business which was otherwise unattainable, so it was decided to organize an equipment company, which was duly organized, the Tungsten Lamp Specialty Company. The idea of this company was that it should be an entirely separate organization—separate officers and finances, and a soliciting force entirely separate from the mother organization. Its function was to be solicitation and overseeing installation of equipment, and the work. All contracts secured should be sublet to contractors on a proper basis; and a blanket figure was secured for wiring and molding. This figure was standardized at $2 per outlet, which included the wiring, molding, and the connections for the service; and the fixtures and reflectors were furnished by the Tungsten Lamp Specialty Company. These solicitors are not permitted to approach Edison customers without permission from the Edison company. As a direct result of this situation, the Tungsten company alone has equipped just a little more than 1,000 stores in Brooklyn, in which there had been no service, and where gas was used exclusively, and which were of a type that it was impossible to secure, largely, before the advent of the tungsten lamp, and largely impossible because of the consideration of expense. The average number of tungsten lamps in these cases is six; 100-watt lamps, practically to the exclusion of all other sizes. The revenue derived from these sources is considerable. As far as it has been possible to estimate it, the revenue derived from these new equipments will average close to $8 a month. This seems large for an equipment of this kind, but it is practically because there are so many long-hour burners. From this equipment it seems that the added revenue to the Edison company is something like $75,000 a year.

J. T. Hutchings (Rochester) said that his company has found the sixty and 100-watt tungsten lamps are not the most popular. With them the most popular lamp is the 250-watt. In one particular barber shop, with only four chairs in it, there are four 250-watt tungsten lamps. The Rochester company has made the prices of renewals to its customers so low that there is nothing in it for others to attempt to handle the business. A reasonable price has been made on large candlepower lamps, making it easy to change from twenty-five to forty, or forty to sixty, with very little additional cost.

Douglass Burnett (Baltimore) said that the Baltimore company offered to cooperate with the contractors and to organize for new business, leaving existing business to take care of itself. It is found that the contractors use the tungsten lamp almost exclusively in connection with additional installations, and there is dissatisfaction. The company then returned to the tungsten lamp by putting out an additional and graduated scale of prices; starting at sixty cents for the clear twenty-five-watt lamp and the forty-watt lamp; sixty-five cents for the frosted twenty-five and forty-watt lamp; and so on up the scale. The tungsten lamp was advertised in many ways through the newspapers and special dodgers, and through the solicitors and customers. They have had excellent results. The company has endeavored to protect the customer from imperfections, defects and early burnouts by taking care of the customer liberally if the lamps are returned soon after installation.

F. M. Tait, Dayton, Ohio, said that in his opinion it would take at least three 100-watt tungsten lamps to equal two gas arc lamps, using the average quality of gas found in the ordinary city. This makes it seem desirable to have the 150-watt tungsten lamp come along as soon as possible. Many of the stores are wired to the gas outlet—gas and electricity at the same point. If we could install at those points 150-watt tungsten lamps, we can displace the average gas arc lamp.

The paper entitled "Practical Illuminating Engineering," by G. A. Sawin, was then read.

The author showed that it was as much the business of the central-station company to see that its product intended for lighting is used effectively by the consumer in securing good illumination as it is part of the business of any manufacturer to see that his goods are properly used and are satisfying his customers. Mr. Sawin gave many pointed arguments to prove the value of an illuminating engineering department to any lighting company, not only in securing new customers, but also in holding old ones. The organization of such a department was described at length. It should have at its head a thoroughly capable illuminating engineer, aided by assistant engineers and inspectors, according to the size of the company. Instead of separate inspectors, the lighting solicitors may be of service; at any rate, there must be complete co-operation between them and the illumination expert. Forms for preliminary and progress reports were submitted, and in general many of the details were discussed upon which the value of the illuminating department would depend.

S. E. Smith, Boston, said that the Boston Edison Company was the pioneer in installing a commercial illuminating division. This was established last Septem-

ber and has been an unqualified success in every particular. The division of "Complaints and Adjustments" was made. This title sounds much better to the customer, who thinks he has a complaint, and it does not advertise that the company recognizes complaints. The real trouble is he needs a dose of electrical engineering. Many congratulatory letters have been received commenting upon the company's progressiveness in this undertaking. Up to June 1 the Boston company has put out about 100,000 lamps. These include renewal lamps. Success has been so great with lighting customers that it has arranged to serve power customers in the same manner, and the company has recently sent out a circular letter to each of its power customers offering to send an expert to look over the installations and make recommendations whereby they can get more efficient use out of their electric power.

Carl A. Schick, Rochester, said that as the Rochester Railway and Light Company is a combination gas and electric company, no effort is made to replace gas arc lamps with large tungsten units. There are but few houses in the downtown section of the city illuminating with gas. With few exceptions, they are using electricity, and have adopted tungsten lamps. The first installation of tungsten lamps made in Rochester was in November, 1907. This installation was followed by many others in a short time, while today it is difficult to locate the business house that is not using tungstens. The Rochester Railway and Light Company renews all burned out or blackened tungstens, provided the consumer signs a maintenance contract. This agreement calls for a weekly inspection of the consumer's lamp. The necessary renewals are made and the entire installation, including the Holophane glassware, is cleaned and polished. A charge of ten cents a month per lamp is made where the consumer's installation is seven lamps and under. Where the installation is eight lamps and over, a charge of eight cents per lamp per month is made. This contract covers all the smaller sizes of tungsten lamps. In the case of the 250-watt lamps, a charge of ten cents per lamp per month is made. The company now has over 5,000 lamps of the larger sizes on this form of maintenance contract. In entering into this maintenance contract, only lamps operated by wall switch are accepted, and no maintenance contract that does not involve caring for all the tungsten lamps in the particular installation to be covered is made.

The paper entitled "Intensive Methods of Business Development," by John C. Parker, Rochester, was read next.

This paper showed very graphically the results to be obtained from a special cultivation of a field in which there had been much unwholesome competition between rival companies and in a very aggravated form. Intensive methods were employed and order, not to mention profitable business, obtained out of chaos. Mr. Parker described the creation by the Rochester Railway and Lighting Company of a new department, a specialized branch of the engineering department, to take care of industrial propositions in conjunction with the company's commercial department. Starting about two years ago with but one man it now has eight thoroughly trained engineers employed in this work. The idea has been to go further than before in finding out just what would be really best for the customer. This has meant a careful study of the customer's processes of manufacturing and close familiarity with his equipment on the part of the industrial engineer. Be it less or more to the company, the customer's mere statement of what he wanted has not been accepted, but the situation considered in all its bearings as to what might be for the best. In many cases an installation has been made free of expense to the consumer, to be paid for at the end of a fair test period if it has proved satisfactory. In no such cases have the results been other than what could be wished. In one case the proprietor of a large hotel had been thoroughly convinced that his steam-driven elevator pumps were extremely costly to operate. He was very anxious that recommendations should be made to him for a motor-driven triplex pump; but a casual examination showed where the exhaust steam could be very advantageously used in other directions, and the company unhesitatingly recommended against the use of its power in this case. If in this instance business was lost, there were gained confidence and good will. Mr. Parker described the personnel of his department, and said the policy had been to give the engineers personal responsibility and identity with the various pieces of work as much as possible. He strongly advocated the collection of data relating to records of tests made on isolated plants and the cost of their operation, and exchange of such information between members of the Association.

This paper was discussed by E. W. Lloyd, Chicago; C. A. Graves, Brooklyn; H. W. Hillman, Grand Rapids; R. S. Hale, Boston; Mr. Penrose, Tynne, Pa.; and others. Mr. Hillman emphasized the value of curve-drawing wattmeters in both lighting and power installations.

This was followed by the papers entitled "Can a Display Room Be Conducted on a Profitable Basis?" by Frank B. Rae, Jr., and "Advantages to Be Derived from Uniform Commercial Department Forms and Methods," by Clare N. Stannard.

THURSDAY MORNING SESSION—FIRST TECHNICAL SESSION.

The report of the gas engine committee, Mr. Klumpp, chairman, was read by I. E. Moultrop, Boston.

A voluminous report was gotten out by the committee on gas engines, which consisted of John B. Klumpp, chairman, Carleton A. Graves and Irving E. Moultrop. The report commenced with an introduction reviewing the work of the previous year's committee and outlining the work of this year's committee, which has gone into the details of design and construction of gas-engine plants operating in electric-power installations, and has obtained actual operating data as far as was ascertainable. Power plants of from 150 to 5,000 kilowatts were examined with a view to determining the local conditions that warrant the installation of gas engines for power purposes, either as a primary or as an auxiliary installation. The gas engine as a power generator was undoubtedly reliable and successful, although local conditions must be thoroughly studied before its installation could be advised in any particular case. The producer had been much improved during the past year and considerable advancement should be made in the near future. Producers, and the theory of their operation, are analyzed in the report at considerable length, and much information is included on gas engines. Some miscellaneous matter on heat diagrams, gases and calorimetry is packed in between the foregoing and a description which follows of the plants visited by the committee. Suggested producer-plant layouts, together with illustrations of representative installations, follow, and successful producer plants of several companies are illustrated and described in detail. The report includes a partial list of the various producer installations in use in this country and a somewhat incomplete list of the gas-engine installations of fifty horsepower and above.

Peter Junkersfeld, Chicago, said he hoped the next committee will make an equally comprehensive and authoritative investigation of the small gas engine that the committee this year made of the larger ones.

Replying to a question by E. F. McCabe, Lewiston, Mr. Moultrop said that as regards the feasibility of a gas engine being installed as a standby in a water-power and long transmission system it seemed perfectly feasible. Exactly that thing has been done at Atlanta, Ga. There they had originally a steam station and the same company owned the gas-works. The waterpower was developed some twenty or twenty-five miles away, and, as he understands, it was a case of the Atlanta company either facing competition with the waterpower or making arrangements to have the total output. They did the latter, and for the first year or so the service was very unsatisfactory, due to line interruptions. Then they decided to install a gas engine as a standby, running with city gas, and that has worked out very satisfactorily. That is one of the plants the committee visited. They saw them start up the engine that had been shut down for something like fourteen or sixteen hours; the engine was started and synchronized in something less than a minute, and that installation has turned out to be quite satisfactory. That is a unit of 2,000 kilowatts.

The paper entitled "Some Features of Condenser and Cooling Tower Design and Operation" was read by M. R. Bump, New York.

The fundamental principle of design and operation of steam condensers is to secure a maximum transfer of heat from steam to water at a minimum of expense for fixed charges. The author went very thoroughly into the advantages and disadvantages of the surface and jet types of condensers and discussed in detail the various points to be considered in condenser design. The most important of these are: Weather and climatic conditions; quantity, quality and temperature of cooling water, at different times; variation in steam results on the unit for varying vacuums; load conditions of the unit to be operated. The introduction of the low-pressure steam turbine emphasizes the importance of high vacuums. In the design and operation of air pumps or dry-vacuum pumps the important items outside of the pumps themselves are: (1)

To keep the piping system absolutely free from leakage; (2) to cool the air entering the pump and remove from it as much of the water vapor as possible. The first necessitates constant inspection, while the second must be cared for in the design of the condenser. A condenser recently introduced from European practice was highly commended for its design. The water pump and rotary air pump are both mounted on the same shaft and can be directly connected to the prime mover, making a very simple and compact unit. In localities where a supply of cendensing water is not obtainable, recourse must be had to the use of cooling towers. These may be of the forced-draft or of the natural-draft type. The comparison of these types involves the consideration of climatic conditions, ground space, cost per unit of surface, as compared with the cost of fans plus the cost of their operation, and the adaptability of towers of varying capacities to the condenser. Some very interesting experiments have been made with a combination of condenser and cooling tower, in which the steam discharged from the unit enters chambers or coils of pipe over which water is sprayed and air rapidly circulated.

A. R. Cheyney (Philadelphia) said that it frequently happens in the design of barometric column condensers that the degree of vacuum maintained will depend almost wholly upon the amount of air present in the circulating water, it having frequently been shown in this type of condenser that when once sufficient water for condensing purposes has been furnished, little increase in vacuum can be obtained if the amount of water should be doubled, the speed of a dry air pump and that of a circulating pump increasing together and in proportion. He recently had occasion to observe some very interesting experiments in the case of barometric column condensers in connection with 5,000-kilowatt Curtis turbines. Six-inch bullseyes of heavy glass were installed at frequent intervals along the length of the discharge column of the condenser and the condensing chamber, and the whole interior lighted by means of incandescent lamps properly waterproofed. Exploring tubes connected through flexible rubber hose to a twenty-four-inch U-tube of glass were inserted throughout the different parts of the condenser and air pump, giving a chance of making a thorough survey of the interior of the condenser under operating conditions. With a vacuum of twenty-eight-and-one-half inches and the injection water at fifty degrees Fahrenheit, the amount of air drawn up through the discharge column and from the upper spray plate of the condenser was enormous. The drop of vacuum between the turbine base and the air pump was easily located, and later by slight modifications in design was considerably reduced, all indications seeming to show that the more readily the air was permitted to reach the air-suction connection the less drop in vacuum.

The paper on "The Use of Reactance Coils in Generating Stations" was read by P. Junkersfeld, of Chicago.

In this brief paper Mr. Junkersfeld pointed out that transmission systems and substation equipment have been quite well provided with protective devices, but the increasing use of high-speed, low-frequency, high-voltage turbo-generators requires special consideration. In such machines on account of the low self-induction the instantaneous short-circuit current may reach as much as fifty times the full-load current. To limit such short-circuit currents by means of reactance coils seems to be imperative. For a machine of large output the design of such a set of coils is a difficult proposition. Two methods of installing reactance coils present themselves. In the first they are placed in the leads between the generator and the busbars; in the second they are placed between the armature windings and the neutral conductor leading from the machine. The latter is possible only with Y-wound generators. The former method would have the advantage of protecting the machine from external surges coming in on the busbars, but would not be of much service in a case of internal short-circuits. The latter method would be of value in such a case, but would not protect the machine from external disturbances. It would, however, probably eliminate the need of resistances in the grounded connection. The use of reactance coils with generators is now being tried on a number of turbine-driven units. Their effect upon efficiency need not be very high; in fact, it could well be within one or even one-half of one per cent. In view of the added reliability of the generator this slight loss in efficiency would be insignificant.

Following the presentation of Mr. Junkersfeld's paper a printed discussion of the subject was submitted by A. S. Loizeaux. In this was considered the experience of the Baltimore Company in designing, testing and operating reactance coils for a 5,000-kilowatt, 13,000-volt, twenty-five cycle, four-pole, 750-revolution-per-minute turbo-generator. Dimension drawings were shown and details described. The coils were made in solenoid form and were air-coiled. No iron was used in their make-up. They were connected into the neutral lead from each generator phase. It was determined that these five-per-cent rectance coils would limit the short-circuit current to about thirteen times full-load current and reduce the power factor of the complete circuit under this condition to thirteen per cent. This corresponds to a torque on the generator at short circuit that would be less than twice full-load torque and therefore safe. The total cost of providing the coils was about three per cent of the cost of the generator. The loss in the coils is about 0.16 per cent of the output. Both these figures are so conservative that such coils may be considered an economical insurance against damage due to short-circuit.

W. L. R. Emmet said that the reactive coil is certainly a reliable adjunct to a power station and everybody should consider their use and thereby save a vast amount of trouble.

Dr. C. P. Steinmetz said the question of the advisability of installing reactances in the generator leads appears to be essentially an economic question which must be answered in the affirmative the more strongly the larger the size of the station. With a 100,000-kilowatt modern steam-turbine station the momentary short-circuiting current of this type of generator, inherent in the type, and therefore irrespective of whose design the machine is, is from forty to fifty times full-load current, which means a short-circuiting current momentarily corresponding to several million kilowatts, and that current potentially may exist anywhere in the generating station and in the feeders near the generating station. Theoretically, it is possible to design switching and controlling devices which will take care of such current. It is, however, hardly feasible, economically, to do that for every generator and feeder switch in the generator station, and to a somewhat decreased extent even in the substation. That means, then, to reduce these enormous short-circuiting currents by inserting reactances in the generator leads so as to bring the current down to a reasonable value. These reactances may be in the neutral, or may be in the phasing. In the neutral, they protect the individual generator also against internal short-circuit, but they do not protect even the generator against the inrush of the short-circuit current from the rest of the system, while when inserted in the phase they do not protect the generator against the internal short-circuit, but protect the system against the momentary short-circuiting current of the system as reduced by the reactance. That means the larger the system, the larger the number of units which operate in parallel, the more essential it will be to use these reactances in the phases and not in the neutral, while with a very few units, their location in the neutral, which is more convenient regarding insulation and installation, may be sufficient.

The paper entitled "Unique Features in Power Plant Design" was read by G. L. Knight, Brooklyn, N. Y.

The paper consisted of short synopses of new features that had been made use of in recent power house construction. These were contributed mostly from central stations in and near New York city. Among the features thus treated were: 1,000-horsepower water-tube boilers; more efficient arch for Roney stokers; deep grates for anthracite coal; ash and soot hoppers as part of concrete foundation for boiler setting; pneumatic ash ejector; spring joints for use on superheated steam lines; concrete air chambers under center aisle of boiler room; blower engine regulated by pressure in air duct; centrifugal boiler-feed pumps; applications of Venturi meters; coal distributor for narrow aisle; turbine-driven circulating pump; auxiliary step-bearing pressure accumulators; Elecrete; fireproof protection for cables not running in conduit; lock bolt disconnective switch; auxiliary switch on oil switches to act as tell-tale in case of switch falling in by gravity; the use of various colored wire combinations for control wiring; improved method for bringing out armature leads; 135,000-kilowatt system automatically synchronized; device for indicating speed of incoming motor-generators; transformer and selective ground detectors; printing attachment for indicating wattmeters; bellows-type time-limit relays; test adapters for calibrating and checking station instruments; signaling systems for use about the power house; transfer bus for two-phase circuits; design of direct-current switchboards; combined operator's desk and pressure wire switch; brushes for ver-

tical rotaries; automatic control for water to water-cooled transformers.

The paper entitled "Efficiency of Motor Generators and Synchronous Converters" was read by F. M. Farmer, New York.

The principal part of this paper was devoted to giving the results of a series of tests made on five different types of equipments for converting alternating current into direct current. These were: (1) Induction motor-generator, (2) synchronous motor-generator, (3) synchronous converter with induction regulator, (4) synchronous converter with synchronous booster, (5) split-pole synchronous converter. The motor-generators were equipped without step-down transformers; the synchronous converter equipments each contained step-down transformers. The motor-generators were installed on the system of the Edison Electric Illuminating Company of Boston, and the synchronous converters were in service in the system of the Edison Electric Illuminating Company of Brooklyn. Each of the five equipments was a 1,000-kilowatt unit, converting alternating current at 6,600 volts to direct current at 250 to 275 volts. The tests were made under similar commercial conditions and comprised a number of determinations of the efficiency at various loads, from the high-tension supply to the direct-current buses. The input-output method was used throughout. The results indicate: (a) That synchronous converters with step-down transformers are more efficient than motor-generators; at full load the difference is about six or seven per cent, at quarter-load it is about fifteen or sixteen per cent, in favor of the converters; (b) between the five different types of converter equipments, the difference in efficiency is small, only three or four per cent at all loads; (c) the induction motor-generator is markedly superior to the synchronous machine of this type; (d) the synchronous converters in each case reached their maximum efficiencies at smaller loads than the motor-generators. The booster type synchronous converter gave the highest calculated all-day efficiency. The paper was concluded with a general summary of the relative advantages of the various types of apparatus tested for various operating conditions. The general conclusion arrived at was that, except for sixty-cycle systems, the use of motor-generators was not justified. The test results were given in tabular form and also in the shape of efficiency curves. There was also given in the paper an outline of the principles of each of the five types of equipments, particularly of the various synchronous converter equipments.

J. L. Burnham, Schenectady, said that in making a comparison of efficiencies it must be borne in mind that the comparison is combined efficiencies, not efficiencies of the converters. Variations in efficiencies which may be obtained on a machine of a good design may be varied from one-half to one per cent by changing the length of air gap. They may be designed so that the losses in the field windings and rheostats will vary one-half per cent. The condition of the commutator as to roughness may cause one-half to three-fourths per cent difference in efficiency. Brush pressure may cause one-fourth per cent difference, and bearing friction and windage may cause as high as one per cent difference in efficiency. The factory tests on split-pole rotaries and transformers show that the efficiency at lowest voltage is 91.9 per cent, at high voltage 93.5 per cent, and at maximum voltage 93.7 per cent, showing a gain of one-and-one-half to two per cent for the higher voltage over the lower. As regards harmonics and distortion of wave form in this machine, it may be stated that the transformer connections used entirely eliminate the third harmonic, the fifth harmonic only being the principal harmonic present to cause harmonic current. A number of oscillograms and no-load readings with the different excitations throughout the range and voltage show that the greatest distortion with the delta connection is somewhere in the neighborhood of five per cent, which is negligible.

The paper entitled "Recent Improvements in Transformers" was read by W. A. Layman, St. Louis.

The recent use of silicon-steel for transformer cores was dwelt on at some length in Mr. Layman's paper, and the influence which this has upon transformer performances was discussed. The most marked effect is the reduction of the core and copper losses of the transformer and a slight reduction in its weight. The author pointed out, however, that if the weight is left the same the performance will be greatly improved. The tendency is toward a gradual reduction of core loss under usual operating conditions rather than an increase. This shows that the new steel is not subject to the usual aging characteristics. The cost of transformers has not been materially reduced by use of this new core material. Accompanying the reduction of core losses there may be a relative increase of the magnetizing or no-load current, due to the higher induction made use of. This feature must be guarded against with care. The parallel operation of these transformers depends largely upon their impedances. The author recommended that manufacturers should publish the impedance of the transformers they build. The reduction of transformer losses in the recent designs has lessened the heating problem. Mr. Layman discussed at some length the matter of making insulation tests of long duration. He concluded with the statement that the user is more interested in the quality of the transformer that he purchases than he is upon the type of construction used. Therefore, he should leave to the manufacturer the matter of design and concern himself with the performance results achieved.

Dr. C. P. Steinmetz said that any lowering of the test standard would work an injury to the industry. Twelve years ago the present test of double voltage for one minute was introduced by the American Institute of Electrical Engineers. It has not been a hardship to the manufacturer and it has been amply high enough to insure good apparatus and has not been too conservative, because the apparatus still occasionally breaks down. He believed the most disastrous thing one could do for the industry would be by a release of watchfulness to lower the standard test.

Mr. Layman said that he did not disagree with Dr. Steinmetz as to the A. I. E. E. standard, but what he had in mind was that there is an increasing number of specifications that call for five-minute tests, and he has also had recently quite a number of specifications calling for thirty-minute tests, for which, in his opinion, there is no justification whatever.

The paper entitled "Low-Pressure Steam Turbines" was read by C. H. Smoot, New York.

Professor Rateau's historic and successful attempts in introducing the low-pressure turbine were briefly described. The low-pressure turbine at first found its most promising application in making use of the steam from highly inefficient non-condensing engines. Later and now, the low-pressure turbine has been utilized as the low-pressure part of a compound unit the other part of which consists of a reciprocating engine acting between boiler pressure and approximately atmospheric pressure. This is the most efficient possible steam engine, although the first cost is higher than that of a turbine plant. The question of combined efficiencies in relation to the admission and exhaust pressures of the engine and turbine was well thrashed out, and was illustrated by tables and numerical examples. An interesting diagram for obtaining the quantity of steam per unit of power developed for given admission and exhaust pressures was given in the printed paper. Condensing apparatus and steam regenerators were next briefly described. The effect of Rateau's well-known regenerator is identical to what would be obtained were it replaced by a simple receiver of enormously greater capacity. Turbines were next discussed, with especial reference to their reliability of operation, and a comparison of the Curtis and Rateau turbines proved somewhat to the disadvantage of the former on account of the greater energy losses from shock on the first row of buckets due to a greater velocity of the entering steam in the Curtis type than in the Rateau. Details of turbine buckets, bucket wheels and turbine shafts followed, and critical speeds of the last were given in a simple formula and shown graphically in a logarithmic plot. Articles on vibrations and oil-ring bearings concluded this valuable and interesting paper.

A motion that "It is the sense of this meeting that a committee be appointed by the incoming administration to take up the subject of cooling towers, condensers and low-pressure steam turbines" was carried, to go before the executive committee of the incoming administration as a recommendation.

THURSDAY AFTERNOON—SECOND COMMERCIAL SESSION.

The second commercial session was opened with the reading of a paper entitled "Electricity for Domestic Purposes," by M. E. Turner, Cleveland, Ohio.

In preparing this paper Mr. Turner had the aid of the following assistant editors: H. W. Hillman, C. Edgar Titzel and W. H. Wissing. Particular reference was made to electrical heating appliances, which were classified as to convenience and necessity. Under the first heading Mr. Turner grouped portable water heaters, curling tongs, coffee percolators, bread toasters, heating pads, cigar lighters, fans, sewing-machine motors, sweepers, air heaters, etc. The second class included cooking outfits and laundry utensils, such as flatirons and washing machines. The sale of these conveniences was made easy by there being nothing in the field to compete with and the editor suggested that he could add little that was new in regard to them. Each central station will handle them to the best advantage according to local conditions. Electric cooking formed the main subject of discussion in the paper and it was gone into very thoroughly. Mr. Turner declared that there are several reasons for believing that the day of elec-

trical household development is breaking. First, a large field of operation has been secured with the growth of residence lighting; second, public interest has been keenly aroused; third, great progress has been made during the last year in the manufacture of electrical appliances. The attitude of department stores in regard to electrical appliances was touched on, and the standardization of certain articles where the principles of design had been fully agreed upon; but it was pointed out that, as yet, owing to the changes of experimentation, there was room for improvement in the relationship between the consumer of current and the manufacturer of electrical appliances.

Opening the discussion, H. W. Hillman, of Grand Rapids, called attention to the advances made by manufacturers of electric cooking and heating apparatus and the cheapening of the cost of these to the consumer.

The first of three papers, closely related, on the subject of power, was then taken up. The paper entitled "Compilation of Load Factors" was read by E. W. Lloyd, of the Commonwealth Edison Company, Chicago.

The rapid adoption of differential rates by central stations necessitates an accurate knowledge of the prospective consumer's probable load factor. For direct-current circuits maximum-demand instruments that are both efficient and cheap are available, but for alternating-current circuits only expensive graphic recording instruments are at all accurate. To supply this deficiency Mr. Lloyd's company prepared a schedule of maximum percentages based on several thousand consumers, who had been using direct current for years. From these results the following table has been adopted for alternating-current power business exclusively:

	Per Cent of Connected Motor Load.
Installations under 10 horsepower, where only one motor is used.....	85
Installations under 10 horsepower, where more than one motor is used.	75
Installations from 10 horsepower to 50 horsepower, both inclusive, irrespective of the number of motors.....	65
Installations over 50 horsepower, irrespective of the number of motors used	55

Out of 3,900 consumers of power, having an aggregate of 35,000 horsepower installed, the average maximum was 53.5 per cent of the connected load. An analysis of these figures was given and also one of 50,000 consumers of electric light in over eighty different classes of business. There were also compiled the average yearly load factors of large power and light consumers, representing over fifty kinds of manufacturing plants. In concluding his paper Mr. Lloyd referred to the desirability of developing a diversified business in order to help raise the load factor of the system. He also urged specific definitions of the load factor.

Mr. Lloyd also presented a communication stating that he had been requested to try to bring out the correct definition of the term "load factor." The influence of the station load factor on the cost of production is being discussed very generally throughout the country. Many of the writers in the current technical periodicals are figuring their load factors on different bases, so that if care is not taken to note just how they arrive at their load factor, the information will be worthless. The simplest definition of the term "load factor" is that it is the ratio of the average load to the maximum load. The period over which the averages are taken on the monthly basis is 720 hours, or, on a yearly basis, 8,760 hours. In arriving at the monthly load factor in any particular installation the average kilowatt load is, therefore, obtained by dividing the total kilowatt-hours used in the month by 720. The load factor may also be expressed as being the ratio of the actual number of kilowatt-hours used in any one month to the maximum possible use (that is, the actual kilowatt-hour consumption divided by the product of the maximum demand in kilowatts by 720). It is obvious that this latter ratio will have the same numerical value as the ratio of the average load to the maximum load. These values are shown in the following expression:

$$\text{Load factor on 30-day basis} = \frac{\text{Average load over 720 hours}}{\text{Max. load.}} = \frac{\text{Actual K. W.-H.}}{\text{Max. K. W.} \times 720}$$

Throughout the country today different engineers and commercial men have many different definitions of the term "load factor." The American Institute of Electrical Engineers' Standardization Rules say "Load factor is the ratio of the average load to the maximum load." This term ought to be more closely defined. The term maximum load factor might mean the ratio of average kilowatts to maximum kilowatts. The term capacity load factor might mean the ratio of average load to capacity of the plant; the connected load factor the ratio of average kilowatts delivered to connected kilowatts, and it might also be stated that there is some misunderstanding as to the term maximum demand; whether the load factor is figured on momentary, one-minute, fifteen-minute or one-hour peaks; whether the absolute or momentary maximum be used, or the average maximum be used in determining the load factor. By applying these different conditions you might have many different kinds of results, such as momentary or absolute maximum load factor, average maximum load factor, to be made up of the average of momentary peak loads, five-minute load factors, half-hour maximum load factors, etc.

For business and practical reasons it may be necessary instead of using the absolute maximum demand of the customer to modify this by lengthening the time of the reading of this maximum. On waterpower plants, five minutes may be a sufficient length of time; on steam plants this time may be lengthened to as high as one hour, depending on the conditions. On ordinary commercial business this period of time should not exceed one-half an hour, because if it does the customer using a large quantity of light could take undue advantage of the central-station company.

In closing Mr. Lloyd called attention to the need for maximum meters for polyphase circuits. He said that there were a few on the market, but that these were in the early stages of development. As the tendency is to sell large volumes of current on a differential rate it is absolutely necessary to have an accurate meter made for the purpose.

The paper entitled "Electric Power" was read by H. J. Gille, Minneapolis.

In the preparation of this paper Mr. Gille was aided by L. B. Buchanan, James E. Davidson, Thomas M. Gibbes, F. H. Golding, G. K. Hutchins, E. W. Lloyd, R. A. MacGregor and Norman T. Wilcox, as assistant editors. The steady development of power load by central-station companies was reviewed. The body of the paper consisted of an analysis of the effect of various classes of power on station loads. In considering to what extent the power load overlaps the peak, a large number of typical load curves were illustrated, in which the combined station load as well as the load of a large consumer in some particular industry were shown. Various classes of manufacture were covered by this series of illustrations. One that was particularly interesting was the load curve of a linseed-oil mill showing an almost continuous steady load throughout the twenty-four hours. In determining the actual maximum demand of any power user the Wright maximum-demand meter has been used for direct-current circuits very extensively and satisfactorily. For alternating-current circuits graphic curve-drawing instruments are necessary in order to show exactly what the nature of the power demand is and its average load factor. These instruments, however, are quite expensive. There seems to be room for agreement upon the length of time for which the demand should be taken as a basis of charge. Demands ranging from instantaneous to an average of thirty minutes are in use; some standard should be established. There is no question but that the greatest possible opportunity for increasing the earning capacity of central stations is by increasing the load factor, or in other words obtaining load off the peak. In this direction the exploitation of electrochemical industries deserves the highest consideration. These require in general an extremely low rate for energy, but usually have a very steady load, which in many cases can be thrown off during the period of peak load on the station. Such chemical industries as make use of the electric furnace are better adapted for intermittent operation than those making use of electrolytic processes. The paper was concluded with a somewhat detailed study of the nitrate industry and its successful exploitation abroad. The conclusion was reached that if power companies can supply power off the peak for twenty or more hours per day at prices below $10 per kilowatt-year they should be able to interest electrochemists.

The last paper of this group, entitled "The Advantage of Group or Individual Drive in Certain Installations," was read by C. A. Graves, Brooklyn, N. Y.

Mr. Graves endeavored to show why group or individual drive is to be preferred in different cases and gave some examples of actual practice to serve as guides to assist others in advising prospective customers. Installations were considered under the following heads: Cost, price of current, machine load factor, shafting friction, motor efficiency, maintenance, speed variation or uniformity, time to make change, floor space, and character of work. In conclusion the author stated that the group-drive installation recommends itself when the shafting friction is low, the rate for current low, and the machine load factor high, while individual motors were preferable when these conditions were reversed.

Opening the discussion, H. W. Peck,

Rochester, N. Y., said that the cost of individual drive should run from $30 to $60 for belted machines, and that as a rule a motor can be geared to a machine for much less than $80. There is a great difference between the cost of installing individual motors in an old shaft-driven establishment and where it is simply a question of what type of drive to adopt initially. In considering the replacing of an old drive Mr. Peck makes a practice of allowing a reasonable rate of depreciation for the old apparatus, which will not be required. The difference between the first cost and these two amounts will represent the amount which it will be necessary to add to the investment on the new equipment in figuring future fixed charges.

Mr. Insull emphasized the importance of improving the load factor even in the smallest stations. The pumping of city water presents a good opportunity for improving the load factor, and the business of supplying interurban railroads with current is an excellent proposition, as the demand for maximum power is in the middle of the summer, when the central station is in the best position to supply it. Mr. Insull wished to impress the importance of dissecting costs and of estimating what factors absorb the generating as well as distributing cost.

R. S. Hale, of the Boston Edison Illuminating Company, said that the method in Boston when the demand indicators are not available is to determine the demand during the winter season by means of tests. In addition instruments can be kept on the service so as to obtain records of any unusual demands. If there is any feeling that the customer is not co-operating with the company in giving a fair test, the instruments can be kept on all the time. With reference to the definition of the term "load factor," it was Mr. Hale's understanding that this meant the annual load factor; that is to say, the maximum of the year, divided by the total amount that could have been used if that maximum had been used throughout the whole year, or 8,760 hours.

In Boston all power and large lighting customers and many small lighting customers are sold on the demand system. These customers pay a fixed charge, or primary charge, based on their demand, and then all the current in addition comes at a low secondary rate. Recently the proposition of supplying current for charging storage batteries for electric vehicles has reached large proportions, and some study has been given to the matter of rates for this service. It seems to Mr. Hale that if any appreciable amount of business is to be obtained by a special off-the-peak price, the demand system gives ample opportunity for this business to be developed.

The paper entitled "New York High-Pressure Fire System" was read by Arthur Williams.

This subject has already been widely discussed in the technical papers, but the question of electrical pumping is always topical, and Mr. Williams' account was both lucid and instructive. There are two pumping stations, each with a capacity of 15,000 gallons per minute. The pumps are of the horizontal multi-stage centrifugal type, working at 300 pounds per square inch at 750 revolutions per minute, with a suction lift not exceeding twenty feet. The pumps, of which there are five in each station, are flexibly coupled directly to their respective motors, which are of the induction type, three-phase, twenty-five-cycle, 6,300 to 6,600 volt, and 800 horsepower each. Pumps and motors were furnished by the Allis-Chalmers Company. The high-pressure system will reach 300 pounds pressure within one minute from starting the pumps. So reliable is this service that in the contract with the city the New York Edison Company agrees to forfeit $500 per minute for any interruption of over three minutes.

This was followed by the paper entitled "Relation of the Electric Vehicle to Central Stations," by J. T. Hutchings, Rochester, N. Y.

In this paper Mr. Hutchings showed conclusively that station load charts require building up of load from 11 o'clock at night to 7 o'clock in the morning. The electric vehicle being used only during the day and evening can be advantageously charged in from six to eight hours during this period of very low load. The Rochester company last December was supplying current to 140 private charging stations and fourteen public garages. In two years the income from the private stations has increased eighty-two per cent compared with an increase of thirty-eight per cent from the public charging stations. In order to stimulate this business the first consideration seems to be the granting of special low rates for the current used. However, a low rate for current induces carelessness on the part of the consumer as to the manner of its use, and generally, therefore, results in detriment to his batteries. It is believed to be a better plan to start a campaign of education to increase the customer's knowledge of the proper methods to be pursued in charging his battery and handling his vehicle in the most economical manner. The company has just organized a department for this purpose, in charge of a competent engineer of wide experience in handling and maintaining batteries. Although organized but a very short time this department has already accomplished a great deal of good in improving the conditions of service of electric vehicles, and has done a great deal of credit to the central-station company for the interest it has taken in this subject. A number of consumers who had had trouble with electric vehicles and were almost on the point of purchasing gasoline cars were persuaded to have their electrics properly attended to, which usually required but a small amount of repairs. The author concluded his paper by advising central-station managers to take up the electric vehicle proposition in the same manner that they are handling the subject of electric power. If this is done, the electric vehicle will prove a better medium for the sale of their product than any that has previously been brought to his attention.

Opening the discussion on Mr. Hutchings' paper, Day Baker, of the General Vehicle Company, said that an entirely new order of things was coming about in the way lighting companies were handling the proposition of charging storage batteries for electric vehicles. He instanced a case where a large central station had been using a three-ton electric truck, fitted with an electric winch for pulling cables. Proper methods of charging and handling had not been applied and the consumption of battery plates was high. The equipment was put in the hands of a new man and a new battery was installed February 15, 1908. Although this vehicle was in constant use hauling heavy loads and pulling heavy cables, often working twenty hours a day, the battery was still in fine condition, capable of doing good work for six months longer before any renewals will be required. A number of other instances were enumerated. The Boston Edison Company recently installed a new equipment the battery of which weighed 1,050 pounds. The car weighed 3,240 pounds, and the average mileage was forty. The cost of current per mile, figured at .04 per kilowatt-hour, was 0.011. This was less than a third of the cost of a former equipment.

F. S. Stone, manager of the Boston office of the Electric Storage Battery Company, indorsed the idea of the central station forming a separate department to go out after electric vehicle business. So much interest is now being taken in this proposition that it appears evident that the good work will go on.

Frederic J. Newman, of the Woods Motor Vehicle Company, said that it was quite necessary for both central station managers and the owners of electric vehicles to receive the best possible instruction as to what might happen to an electric vehicle, and this did not include electrical troubles only, but applied to the mechanics of the machine and also to the physical injuries, which were quite possible at all times. He thought that it was necessary for the central stations to make the rate as low as possible and educate the vehicle owner to having the batteries kept well charged and in perfect condition.

Mr. Hibbard of Rochester said that it had been his experience to find more batteries ruined by overcharging than by being overworked.

Mr. Stone said that there had been so much difficulty in garages in not treating the batteries right that the company had established a battery inspection department, and made it a practice to furnish suitable men, and, in fact, was glad to train men at the main factory and at any of the Exide depots.

Samuel Scovill, Cleveland, said that there were a large number of electric vehicles in Cleveland and that satisfaction with this type of carriage was increasing. Less battery trouble is found than formerly, and this is attributed to the method of handling the cells and the vehicles.

M. E. Turner, Cleveland, did not think the statement that automobiles are always charged off the peak was justified. He had a record of 503 stations, including thirteen public garages and 150 stations, in which the current is sold through meters; 335 metered the current through the

house-lighting meter. The garages that are separately metered turned in a revenue of $10,000 a year, at a 0.06¼ rate. The 338 stations with the house meters at a 0.05 rate turned in about $20,000 a year, or about $70 per annum for the former and $60 for the latter stations.

J. H. Vale of Long Island City, presented some figures on the annual cost of keeping horses, cleaning streets and maintaining hospitals. He estimates that the annual saving of electric wagon delivery to replace 100,000 horses is $100,000,000.

T. C. Martin of New York said that he had found every evidence of an awakened, intelligent interest in the subject of the relation of central stations to the electric vehicle business.

F. M. Tait, of Dayton, Ohio, recommended the electric vehicle as a profitable source of new business.

THURSDAY AFTERNOON — SECOND TECHNICAL SESSION.

The report of the committee on protection from lightning, B. E. Morrow, chairman, Albany, was presented by M. O. Troy.

This committee, consisting of B. E. Morrow chairman, H. B. Gear, O. A. Honnold, N. J. Neall and J. F. Vaughan, reported that on distributing systems the number of lightning-arrester equipments is now very large and the failures thereof comparatively small. On transmission systems the failures were found almost entirely on the lines themselves and very rarely in the station apparatus. The recommendations for distributing systems were: A preference of pipe grounds instead of plate grounds, as being more convenient to install and just as effective; the spacing of lightning arresters should be approximately 2,000 feet apart; careful record of damage to apparatus and of interruptions to service each year should be kept; frequent and systematic inspection of arrester equipment is necessary. For the stations of transmission systems there is recommended: The installation of several types of arresters in parallel; use of choke coils; the general good service of multi-gap arresters; use of aluminum-cell arresters where other types are found inadequate. On the lines the use of arresters is considered inadvisable; instead there is recommended the placing of a steel cable above the center of the operating lines, which is grounded at each tower or at every 200 or 300 feet on pole lines; the use of lightning rods extending above the grounded wire at each grounded point prevents the splitting of poles.

D. B. Rushmore, Schenectady, said that there has been in the last year a greater actual advance in this field of lightning arresters than at any other period. The aluminum-cell arrester is not an experiment. It is an apparatus for alternating-current circuits. If there is any locality that is subjected more than another to severe tests of lightning storms it is in southern Colorado. There the Animas Power and Water Company has this apparatus in use. The Southern Power Company, of North Carolina and of South Carolina, has had considerable experience with these arresters, and it reports that it is almost perfect as a real protection—that is, it will actually prevent the voltage from rising more than the amount for which the arrester is set, so that if you put the lightning arrester outside of an alternator and set it, say, for sixty per cent above the voltage, no disturbance coming in from the line can hold over sixty per cent without making a very rapid discharge—that is, anything over sixty per cent is very rapidly discharged, and the rate of discharge varies with the increase in voltage.

The report of the committee on overhead line construction was read by Paul Spencer, Philadelphia.

The committee was composed of Paul Spencer, chairman; J. F. Dostal, Sidney Hosmer, G. H. Lukes, W. T. Morrison, Farley Osgood and Thos. Sproule. Its report, covering seventy-eight pages, treated the first two of the nine main topics into which the committee has subdivided the general consideration of overhead work. The remaining topics are to be taken up by subsequent committees. The two topics considered in the present report are (1) poles and pole settings, (2) stringing of line wires. The following items were given special consideration on account of the present lack of uniformity or the special importance of the subject: Cross-arms, copper wire, braces, strain insulators, guy wire, preservative treatment of poles and cross-arms, galvanizing. General specifications on material were submitted for: Wooden poles and cross-arms, cross-arm braces; cross-arm bolts, carriage bolts, lag screws and washers; pole steps; pole pins; stranded guy wire; strain insulators; guy rods; galvanizing iron and steel; copper and aluminum line wires, with weather-proof insulation; rubber-insulated tree wires. By the aid of thirty-four illustrations specifications for standard construction methods were submitted for series street-lighting circuits and for constant potential distributing circuits, employing up to 2,300 volts nominal. These specifications covered 134 detailed sections, dealing with the following groups of subject: Poles and pole-setting, cross-arms, pins and insulators, pole guying, wire and wire stringing, and location of wires. In general the report was an attempt to standardize materials and construction methods along the lines of the most approved practice.

The paper entitled "Recent Development in Secondary Distribution Work" was read by W. K. Vanderpool, Newark, N. J., followed by the paper entitled "Requirements and Specifications for Extra High Potential Transmission Lines," by A. S. Ives, Poughkeepsie, N. Y.

The first paper went into the details of secondary-line construction quite fully. Attention was given to the connection of consumers' services and various types of pole fixtures, and building and corner brackets were described and illustrated. This matter was considered not only with regard to overhead lines, but also as regards connection from conduit systems. Considerable attention was devoted to the proper methods of placing transformers. Their suspension on poles was described as it has been applied in various recent installations, both for single transformers and for sets of three on a three-phase circuit. The latter are usually mounted upon a platform support the details of which were described. A discussion was entered into on the subject of proper methods of grounding secondaries and of a number of satisfactory methods used for interior block or backyard distribution; both the high pole and the short terminal pole for this kind of distribution were described. The latter is generally used in connection with conduits and cables. A concrete pole has found favor for this service. In the congested portions of cities, as well as in locations where alleys are not prevalent, the distribution must be from the front of the building, and preferably from beneath the sidewalk into the basement. A number of features relating to sidewalk distribution were considered.

The paper on "Requirements and Specifications for Extra High Potential Transmission," dealt with the 33,000-volt, three-phase transmission line constructed by the companies with which the author was associated. On the same poles provision was also made for a private telephone line and a 2,200-volt, two-phase primary distributing circuit. Specifications were given in the paper covering the following subjects: Poles, cross-arms, pole irons, pins, insulators, copper wire, overhead ground wire, grounding, telephone circuit, special construction for steep grades and cliff climbing, alternative use of aluminum wire and other miscellaneous items. After discussing many of these points, Mr. Ives concluded his paper with the following recommendations: (1) Select one of the standard voltages adopted by the American Institute of Electrical Engineers; (2) secure an adequate and permanent right-of-way, with ample cutting privileges; (3) build your line with ample strength throughout all its details, and ample sags in the spans; (4) use an overhead ground wire, with frequent groundings; (5) maintain cordial relations with the owners of property through which your line is built.

Opening the discussion on these three papers, Farley Osgood, Newark, N. J., said that he could not agree with Mr. Ives in the statement in his paper that it is a good thing to put distribution wires on moderately high voltage up to 2,300 volts on a pole line with 33,000 volts on top of it. From his own experience he could assert that he would have a lot of trouble if he undertakes to do that.

In replying to a number of questions Mr. Spencer said: "As to metal pole caps, that point was not brought up with the committee at all. Iron pole pins were considered, but were not specified, as we looked upon the wooden pin as the standard pin to be used. Galvanized steel coil was considered as being used and as having certain great advantages. I believe galvanized steel is an arm that could be used, and I think it might very well be added to the specification. In reference to strain insulators and the insertion of guys and the question of attaching guys to undergrounded sppports, my idea was, of course, to keep the guy, if possible, out of reach of pedestrians and still give it all the insulation that was possible. In keeping it out of the reach of the passerby and giving it all the insulation we could, we could both protect anyone who might come in contact with it from the ground and also serve as a protection to the man working on the pole from getting in contact with a grounded guy wire while he was working on high-tension lines. We believe that a strain insulator eight feet from the ground would be far enough away to be out of reach, and of course we are working there under certain definite limitations, namely, the guy must come as close to the ground as is convenient—that is, the greatest stability will be obtained by bringing it down as near to the

ground or to the base of the tree as it is possible to bring it, and therefore putting it at eight feet was as near as we could and still keep it out of reach."

A motion was carried that the incoming administration appoint a special committee on the subject of the preservative treatment of poles and crossarms and report at the next convention.

The report of the committee on grounding of secondaries, W. H. Blood, Jr., of Boston, chairman, was read.

The report reiterated the recommendations made last year. It showed that the resolutions adopted by the Association at the last convention making the grounding of secondary circuits up to and including 150 volts compulsory and prohibiting it where the voltage was in excess of this figure has been endorsed by the Underwriters' National Electric Association, which has agreed to recommend it in all instances, even though it cannot enforce this regulation since the provision is a life hazard and not a fire hazard. The committee showed clearly in its report that the grounding of circuits in excess of 150 volts would be nothing short of criminal. As regards the manner of grounding, the use of iron pipes an inch or more in diameter and driven eight or ten feet into the ground has been found very satisfactory. About such pipes a liberal quantity of salt should be placed. In general, however, there is no method of grounding equal to that obtained by connecting to an underground metallic water-pipe system. No objection should be made to this on the part of the waterworks engineers because under no conditions is it detrimental to the water-pipe system.

Mr. Blood added that there were really two points in this paper that were susceptible to discussion—one, whether the limiting voltage should be 150 volts or not, the other being the question of the method of connecting to the ground. The latter, the committee believes, is susceptible of easy solution, requiring only time and testing to demonstrate what methods are the best.

Peter Junkersfeld, Chicago, said that 150 volts as a sharp dividing line is something that is liable to lead us into a good deal of danger. If it is well to ground at 150 volts, may it not also in some parts of the country be correct around 200 volts? There is a great deal of difference in the quality of the ground it is possible to secure in different parts of the country, and a great deal of the protection depends upon the effectiveness of the ground. The committee has secured considerable evidence showing that fatalities have occurred in contact at 200 volts. That is unquestionably true, but how about the evidence on the other side of the case—it is purely a question of balancing one risk against another risk. In one case you are continuously subjecting your patrons to an accidental grounding of, say, 150 to 200 volts, which may in a few cases have been fatal. The risk on the other side, however, is that you are continually subjecting them to accidental grounds, crosses, breakdowns in transformers, which, if these crosses or breakdowns in your transformers occur at that moment, is sure to be fatal. A shock of 200 volts is not necessarily fatal. The recommendation of this association, if it should find its way into the National Electrical Code, would bind the members of this association practically hand and foot. Should you go into court with a damage suit on your hands the court will undoubtedly hold that you are not following the prevailing practice which could be said to be regulated by the National Electrical Code—you are negligent, so that it is a very serious thing and it is a matter of a great deal and far-reaching influence.

Dr. Steinmetz said that regarding the question of grounding or not grounding there are two viewpoints—that of the fire risk and that of the life risk. He believes we should consider these two separately; where the conclusions of both the viewpoints agree the question is settled. Where they disagree we should bring down the responsibility to where it belongs, whether we incur the risk to life, which might be avoided for the purpose of reducing the fire risk, or whether we are willing to incur some additional fire risk to make the circuit as safe to life as possible. As regards the fire hazard, which is the only one of financial importance to the underwriters, in the early days of electric lighting the insulation was somewhat of a mystery. Naturally the tendency was to use walls of houses and the woodwork for a large part of the insulation, but now the art knows how to insulate for any voltage, whether 110 or 1,000—we can make the insulation safe, and provided we insulate it properly we can make a circuit safe. We can make it safe against 110 or 1,000 volts, but we cannot make a circuit safe against unknown voltages; while we expect 110 volts, there may be 60,000 volts, so there is that potential danger against which we cannot insulate because we do not know how high the voltage we may have in a circuit. The only protection against this is grounding the circuit, and therefore his conclusion regarding the fire risk is that the only way of making a circuit as safe as it can be made for fire risk is by grounding, and he would, from the point of fire risk, make mandatory the grounding of every circuit which enters an insured building, whether 110 volts or 1,000 volts.

Dudley Farrand, Newark, N. J., moved that the report of the committee be received and filed and that part of the recommendation so far as making grounding mandatory up to 150 volts, where reliable ground is obtainable, be agreed in, and that the further recommendation that grounding in excess of 150 volts be not agreed in, but referred back to the committee for further report. The chairman put the motion, which was carried.

Dr. Steinmetz moved a recommendation that the safest method of protecting life was the grounding to the water pipe, and also stating that such a ground is perfectly safe and involves no risk of destruction of pipes by electrolysis or other means. The motion was put to vote and carried.

The paper entitled "Performance Specifications and Ratings" was read by W. L. Waters, Pittsburg.

The present system of rating has not proven reliable. Too much attention is being paid to the figures given on the name plates of machines. Performance guarantees are particularly unsatisfactory as to (1) temperature rise on all generators and motors, and (2) power-factor of the load for which alternating-current generators are guaranteed. The temperature limit of output is not decided by temperature rise, but by the absolute temperature of the insulation, i. e., the temperature of the room is an important element to be considered. Mr. Waters considers that the most rational system of temperature rating is to specify the maximum constant load at which the machine can be safely operated with a standard room temperature, say, twenty-five degrees Centigrade, and possibly a two or three-hour overload with the same room temperature. As to alternators the importance of considering the power-factor is due to its bearing on operation. It is common to specify 100 per cent power-factor machines where they will actually operate with a power-factor of sixty-five to eighty-five per cent. Surprise is often expressed when it is found that a 100 per cent power-factor alternator will not carry more than fifty per cent of its rated kilovolt-amperes when operating under those conditions. Therefore the author recommends that a nominal rating at 100 per cent power-factor be used, supplemented by a statement of the maximum load which the machine will give at various lower operating power-factors. In general a closer study of operating conditions is required and then the selection of machines best suited to fit these conditions.

S. D. Sprong, New York, said that it is an engineering fact that the limit of capacity of a generator is determined by its actual temperature, regardless of the fact whether it has come to this temperature after a small rise over the rather high temperature of surrounding air during summer, or a considerable rise over the surrounding air as it may be during the winter. This means that the indicating wattmeter or ammeter is not a true guide under such widely varying conditions, and it should not be expected of the station operator that he can determine by some peculiar intuition just what the temperature of the air that is in immediate contact with the machine may be, and then how much of a rise is permitted before reaching the safe temperature of the machine. In other words, he has nothing definite to guide him in determining the safe maximum load that his generators may carry under the conditions as they exist at that particular time. This discrepancy might, however, be supplied if it were possible to devise an indicating thermometer or pyrometer which would indicate at the switchboard the actual temperature of the windings. Then the operator would have something definite and a safe limit could be placed on the temperature to which all load conditions could be adjusted. This would take into proper account the varying temperature of surrounding air, or variations in ventilation, and would eliminate most of the uncertainties at once, and indicate directly

the one factor that so vitally determines the life of the machine.

The paper entitled "Central Stations in Towns of Less Than Four Thousand People" was read by J. S. Knowlson, Schenectady.

THURSDAY MORNING—FIRST ACCOUNTING SESSION.

The accounting session was held Thursday, June 3. The morning session was called to order at 10 a. m. by Chairman Frank W. Frueauff, who surrendered the chair to Vice-Chairman H. M. Edwards while he addressed the meeting. Mr. Frueauff said that the Association had had an accounting committee for the past three years, and it had developed on investigation that the most unusual and surprising differences existed in accounting methods among the various member companies. It was evident that here was room for some earnest work in perfecting a properly organized and equipped accounting system, which ought to be of value to the entire corporation. The report of the accounting committee was then presented for discussion.

Charles R. Price of New Bedford suggested that although the report had been read on Tuesday morning, it would be well to reread or abstract it, so as to keep the matter fresh in mind. The chairman accordingly gave a very full though concise abstract of the report, following which a very extended discussion took place.

Charles R. Price emphasized the desirability of a uniform system of accounting. He told of the varying methods of comparison which obtained in Massachusetts, in spite of the scheme laid out in that state by the commissioners.

The chairman, in answer to a request by Mr. Price, told of the methods in vogue in New York, and C. N. Duffy of Milwaukee of the methods used in Wisconsin. Mr. Duffy gave some details of the Wisconsin Railroad Commission's classification of accounts. This commission is composed of three persons—one skilled in law, another in finance and accounts, and the third in transportation and public-utility business. Visits were made all over the state and various conferences with associations and divers authorities were held. Mr. Duffy went into the work of this commission at great length.

G. W. Claflin raised the question of current used by auxiliaries in the power station itself, which, Mr. Duffy remarked, was taken out when estimating the number of kilowatt-hours to be used in making comparisons.

F. L. Dame suggested a coal analysis showing the amount of ash as well as the heat units.

Bryan H. Allen, Louisville, Ky., said in this connection that better relative costs would be obtained by comparing coals by British thermal units. Several other gentlemen spoke in the discussion, which was finally closed and the report accepted.

The next item was a paper by E. J. Allegaert, of the Public Service Corporation of Newark, on "Branch Office Accounting," which was followed immediately by the somewhat similar paper, "Customers' Accounts," by L. A. Wallace of Boston, after which the two papers were discussed together.

John H. Gulick, of the Chicago Edison Company, mentioned the use by his company of the Hollerith System in checking absolutely the extension of bills.

W. E. Freeman, of the New York Edison Company, said that his company centralized the work of rendering bills in the main office and used the Hollerith System for tabulating earnings, which latter were classified by territory and also by classes of business.

H. R. Kern spoke at length of the methods of the Philadelphia Electric Company, and E. H. Robinson of the system used in Schenectady. Messrs. Carter, Hodgson, Scobel, Schlegal, Price, Jones, Rogers and others also contributed valuable information in the further discussion. This was all replied to by the authors of the papers, when a recess was taken until 2:30 p. m.

THURSDAY AFTERNOON—ACCOUNTING SESSION.

The afternoon session was called to order at 2:30 p. m. by H. M. Edwards, who acted as chairman.

W. W. Freeman read a paper on "Payroll Problems," which consisted in great part of the payroll system, etc., of the New York Edison Company. In the printed record of the paper were reproductions of the payroll card, job card, calculagraph job card used in the repair shops, instruction cards for the various departments, time voucher, payroll sheet, payroll change slip, and the like, used by the company.

The paper was discussed by Charles R. Price and the chairman.

John L. Bailey then read a suggestive paper on "The Care and Handling of Supplies." Mr. Bailey gave typical forms of requisition blank, order form, stock and cost card, material receipt sheet, purchasing agent's railroad record sheet, and many other well-devised cards, etc., for the use of a supply department.

The paper was freely discussed by Messrs. Bailey, Allegeart, Dame, Bogart, Gulick, Freeman and the chairman.

The next on the programme was "Cost Accounting," by H. R. Kern of Philadelphia. Mr. Kern said that not until the eighties was the science of costs of sufficient magnitude to be seriously considered by either Europe or America. Since 1890 the question had been seriously taken up, and it was safe to predict that an exact appreciation of the true value of costs will soon prevail in all branches of business, to which it may be profitably applied. Mr. Kern gave a brief review of the progress in this line up to the present time, with special reference to the Philadelphia practice.

At the request of the chair, Mr. Holme, of the New York Edison Company, gave an account of the New York job-keeping system, which is very much like the Philadelphia system.

Messrs. Dame, Spoehrer, Price, Gardiner, Thomas, Robinson, Rubright, Allegaert, Freeman, Bogart, Mueller, Wallace, Rogers, Gulick and Bailey contributed freely to the lengthy discussion that followed.

The last item was a paper on "Depreciation Accounting for Small Companies," by George W. Claflin. Mr. Claflin said that it is a good plan for small companies to accumulate a reserve through monthly charges for depreciation, thus spreading the amount over the life of the property and avoiding large, irregular charges. The author recounted the methods of the New York commission, which requires in its rules that a monthly charge to operating expense shall be made for the estimated depreciation to tangible property for (1) Wear and tear, (2) Obsolescence, (3) Inadequacy, (4) Extraordinary casualities. The subject was then taken up in detail under these heads. In conclusion some records from experience were given, including a table showing total maintenance percentages (of gross receipts) (8.10 to 10.90), additional allowance (6.84 to 8.45), and total depreciation (16.40 to 17.79) for the years 1904 to 1908 of a certain small company. A long and interesting discussion followed, whereupon the meeting finally adjourned.

FRIDAY MORNING—THIRD COMMERCIAL SESSION.

With W. W. Freeman presiding, the meeting was called to order at 10 a. m. The first paper considered was that entitled "The Adoption of Electric Heat for Industrial Purposes," by Charles Russell. As Mr. Russell is now in Europe, Mr. Meyers presented an abstract of the paper.

Mr. Russell and the assistant editors first of all brought forward in their paper the present status of this side of industrial development, remarking "that conditions are ripe for the intervention of the central-station industry and the extension and development of this class of business." Then the paper urged the importance of collecting sufficient data particularly in view of the enormous activity in electric furnace work, and the new epoch being entered on in the application of electric energy for chemical and metallurgical purposes—a rational development. Various heating units and their existing successful applications in the metal trades, printing and publishing trades, leather industry, wood-working establishments, the celluloid industry, the clothing and textile trades, laundries, paper trades, confectioner and baker shops, automobile garages, optical trades, branding devices, appliances for hospitals, surgery and dentistry, and general uses were all taken up in turn and succinctly reviewed. The paper was very much alive to the possibilities of this new industrial departure. It brought up point after point and was productive of interesting discussions. The assistant editors in its preparation were: James I. Ayer, Cambridge, Mass.; E. R. Davenport, Providence, R. I.; Frank H. Gale, Schenectady, N. Y.; W. S. Hadaway, Jr., Pittsburg, Pa.; Jos. D. Isreal, Philadelphia, Pa.; George B. Johnson, Chicago, Ill.; George M. Keebe, Brooklyn, N. Y.; C. K. Nichols, New York

city; La Rue Vredenburgh, Boston, Mass.; R. R. Young, Newark, N. Y.

In discussing the paper, J. F. Becker of Brooklyn described the outfit of matrix tables of the *Brooklyn Eagle*. The outfit consists of three single-page tables, one double-page table and one matrix-rolling machine. It requires a five-horsepower motor and an air compressor operated by a 7.5-horsepower motor. If gas-heated and steam-driven the equipment would cost to operate about fifty per cent more than the electrically heated outfit.

A paper by George Williams on "Electricity for National Advertising" was presented in abstract by Mr. Campbell.

Mr. Williams suggested that the Association collect information from each Class A member and compile it in book form, profusely illustrated, for the benefit of members, national advertisers, advertising agencies and sign builders on the following lines: (a) List of available local roof locations, their descriptions and terms of rental; (b) flat rate of service for four candlepower and upward per year of six and twelve-hour nightly burning (inclusive of lamp renewal and sign-cleaning cost); (c) names and brands of products already advertised by electrical display, accompanied by photographs. He declared the electric sign to be the greatest attraction known, compelling the attention of everybody and pleasing in a way nothing else did. The beauty, variety and brilliancy of designs were without limit and obtain for these signs much extra and gratuitous notice and attention from the press everywhere. The women admire the display because they brighten the city. Real estate interests are keen to see electric signs go up. People pause to read and reread them. Electrical advertising gives distinction to the product advertised. Electrical publicity costs little. Mr. Williams gave some estimates of the amount being spent and likely to be spent, and closed his pertinent, pithy and snappy paper with the forecast of a greatly increased distribution of outdoor electrical national advertising in the immediate future.

T. I. Jones of New York took issue with Mr. Williams on the use of signs with exposed lamps only, because in New York city there was tried recently the use of tungsten lamps in billboard reflectors with very marked success.

Henry J. Gille suggested that in electric-sign development for national advertisers this Association should take up the question with the National Posting Service, an institution which has control of the billboards all over the country and can bring about good results because it has some very excellent salesmen, who are constantly in touch with national advertisers.

W. H. Gardner, Boston, said that in New York city there is being erected a structure on the site of the old Metropole Hotel, Forty-second Street and Broadway. It will be six stories high and used as an office building. Above that, the structural steel work for a twenty-story building will be run. The upper fourteen stories are being built solely and exclusively, for the present, for the purpose of carrying electric signs. This is the first time that the greater part of a building has been used exclusively for this purpose. The rentals from sign spaces on that structure make it figure as a very much more profitable structure than if it were to be devoted entirely to offices, even with the high rentals which are paid in that locality.

Others who discussed the subject were C. N. Stannard of Denver and F. M. Tait of Dayton. The latter sought aid by which national advertisers may be induced to introduce their electric-sign advertising in cities of 100,000 or less. The interurban lines bring into such communities probably four times the population that the city itself contains, and it ought to be a good field for this class of business.

The next paper was presented by Theo. I. Jones. It was entitled "The Development of Revenue from Existing Customers."

Mr. Jones outlined the best methods for obtaining further business from a customer, giving examples and also deliberate methods for "stalking the quarry." He briefly alluded to such points as new customer methods, existing customer methods, rate conditions, publicity methods, trial propositions, development inspection and results. Under the heading of trial propositions he gave as illustration the sending out of 200 electric irons for a six months' free trial to apartment residential customers in New York city, and told how of the first 100 delivered sixteen were refused, the reason being that no package had been ordered, but of those sixteen four were eventually retained after an explanation had been given by the expressman. The report of the revenue of the first two months showed an average of seventy cents per customer a month, or $4 for the six months; materially above the cost of the iron even though the customer should not finally accept and pay for it. Mr. Jones gave forms for the agents daily report, for the development inspection report, and recommendations made thereon. The paper was replete with ideas on how to extend and develop business, and proofs in the form of concrete results were cited.

The discussion was opened by H. J. Gille. He thought that if the manufacturers realize the importance of getting out their advertising matter on current-consuming devices in such form that it can be used by the central-station company and sent to its customers or prospective customers, there would be considerable gain, because there are many of these companies that cannot afford to issue advertising matter of such high order as is now commonly put out. In the development of the electric iron business his company has irons out on a loaning basis for a number of years, and has probably eighty-five per cent of its residence consumers using electric irons. J. F. Becker and C. N. Stannard also contributed to the discussion.

An address on the general business progress was then made by Hon. Frank Bergen of New Jersey. This address, which teemed throughout with humor, dealt with the tremendous progress made in the material condition of the masses during the past century and the revolutionary industrial methods which are partly the cause and effect of this progress. The corporation of today has been exposed to severe assault by agitators, but it is an essential and most beneficial part of our industrial life when properly managed and legitimately regulated. Mr. Bergen's address was received with enthusiastic applause.

At this point the commercial programme was put aside till the afternoon and the meeting resolved itself into an executive session for the disposal of routine business of the Association.

FRIDAY MORNING—EXECUTIVE SESSION.

The first matter taken up for consideration was the report on memorials, by T. C. Martin. Mr. Martin said that the association was to be congratulated upon the fact that during the past year it had not lost a single active member from its ranks. However, he desired to mention the names of Gen. A. K. Stiles, Dr. W. M. Habirshaw and J. V. S. Church, who had at previous times aided the association, or done much for the development of the electrical industry in America. Mr. Martin's report was ordered printed in complete form later.

The report of the nominating committee, consisting of C. H. Hodskinson, C. R. Huntley, W. J. Barker, S. H. Conklin and N. F. Brady, was read by the secretary. The committee submitted the following nominations:

President, to serve for the year ending July 1, 1910, Frank W. Frueauff, of Denver.

First vice-president, W. W. Freeman, of Brooklyn.

Second vice-president, John F. Gilchrist, of Chicago.

Secretary and treasurer, Frank M. Tait, of Dayton.

Members of the Executive Committee, to serve until July 1, 1912, C. A. Stone, of Boston; Dudley Farrand, of Newark, and H. M. Byllesby, of Chicago.

On motion of Arthur Williams, of New York, the report of the nominating committee was received and the secretary instructed to cast a joint ballot for the election of the nominees. The ticket as announced was thereupon declared duly elected.

Dudley Farrand escorted Mr. Frueauff to the platform and the latter made a brief address, expressing his gratitude for the election.

Resolutions were adopted thanking W. D. Weaver for his generous presentation of copies and files of electrical books, publications and periodicals to the permanent library of the association.

The customary resolutions were then adopted thanking the convention committee, the reception committee and the entertainment committee for their effective work to make the Atlantic City convention of 1909 a brilliant and memorable success.

Henry L. Doherty submitted the report of the committee on amendments to the constitution and also the committee on the president's address. The report states that there are abundant reasons why the thorough organization of the central-station business should be accomplished

by a special organization in each state, working in harmony with each other, through the instrumentality and with the support of the national organization, and predicts that the desirability of this plan will be readily recognized by the alert members, and will result in the speedy organization of various states. By the adoption of the proposed amendments of the constitution provision will be made for the complete organization of the central-station business to reach (a) every part of the country by means of Geographic Sections; (b) every class of work by means of National Special Sections; (c) every employe by means of Company Sections; and (d) every opportunity and every emergency by means of National Conferences. The president's recommendation that adequate provision be made for the financial support of the various branches of the organization has been considered, but the committee was unable to make concrete recommendations, and thought best to leave the matter for the action of the executive committee.

The committee recommended that the following amendments to the constitution be adopted:

Article IV, Section 3, insert after "Vice-presidents" in line 2 the words, "and Presidents of Geographic Sections."

Article VII, Section 3, add the following clause: "including membership in any one section and $2.50 additional for membership in each additional section. Membership in Company Sections, however, shall not be counted in computing dues, in cases where company sections waive, in advance, their claims to any appropriation for expenses under Article XVI."

Section 6, add the following clause: "including membership in any one section and $2.50 additional for membership in each additional section. Membership in company sections, however, shall not be counted in computing dues, in cases where Company Sections waive, in advance, their claims to any appropriation for expenses under Article XVI."

Add the following new Article to be known as "Article XV: Section 1. Upon the application to it by not less than ten Class A members, the Executive Committee shall authorize the organization of a National Special Section of lawyers, accountants, engineers, purchasing agents, commercial men, or of any other class of persons connected with the conduct of the central-station business.

"Section 2. No person not a member of the National Electric Light Association shall be eligible to membership in any National Special Section of the National Electric Light Association.

"Section 3. The form of organization of each National Special Section shall be subject to ratification by the Executive Committee.

"Section 4. The time for holding National Section conventions shall be subject to the approval of the Executive Committee or the President."

Renumber present Article XV to Article XVI and amend said Article as follows: Insert, following the words, "Geographic Section," line 2, the phrase "of any Company Section or of any National Special Section."

Strike out the phrase "plus one-half the amount of entrance fees received by the National Electric Light Association during the preceding year from members (other than Class A and Class D) of said Sections."

Renumber present Article XVI to Article XVII.

Renumber present Article XVII to Article XVIII.

On motion of Arthur Williams the report was accepted and the amendments to the constitution adopted by the unanimous vote of the Class A members.

P. S. Young then moved that the report of the committee on a uniform system of accounting for electric-lighting companies, be received, and the classification of construction and equipment accounts therein recommended be adopted as the standard classification of the association. Henry L. Doherty believed that the convention had not had a proper opportunity for the consideration of this matter, and therefore moved as an amendment that the report be received and placed on file, but no adoption be made of anything.

Mr. Edwards, chairman of the accounting committee, protested against further delay. He called attention to the fact that the committee worked hard on this classification last year; its report was presented at the first general meeting, and discussed at the parallel accounting session. He believed that much good would be accomplished by putting the committee in a position of appearing before the various state commissions with a standard classification as adopted by the association.

W. W. Freeman moved, as an amendment to the amendment, that the report be referred to the executive committee with power, if it thought wise, to approve the classification of the report. The motion as finally amended was adopted.

On motion of J. E. Montague, resolutions were adopted thanking the members of the various standing and special committees for their efforts and labors of the past year.

T. C. Martin also submitted similar resolutions that were adopted expressing the thanks of the association to its officers and the members of the executive committee for the zeal displayed in the direction of its affairs, and the unremitted vigilance with which its interests have been fostered, particularly as to the splendid growth of the year and the widening of the area of the influence of the association.

Mr. Whitfield, of Richmond, moved the appointment of a committee to investigate the progress of electrochemical industries, such as the electric processes for making nitrates and refining metals. This was ordered.

There were also adopted, by a standing vote, resolutions of thanks to the exhibition committee, to the Class D members, to the Hotelmen's Association of Atlantic City and to the local committee of arrangements.

After a short concluding address by President Eglin, the session was adjourned.

FRIDAY AFTERNOON—FOURTH COMMERCIAL SESSION.

The discussion of Mr. Jones' paper was resumed by Mr. Osborne, of Spokane. The method used there for selling and bringing into use the electric iron is through one of the daily newspapers, which sells the irons to the consumers for five cents a week, for sixty-five weeks, in addition to the regular subscription price for the paper. They have distributed something like 6,000 irons for the company in three years. The manager of the circulating department of the paper spoken of said that they could not get out of the business now if they so desired.

The paper was discussed further by Messrs. Sutton, Smith, Jones, McCabe and Burnett.

At this point President Eglin turned the meeting over to Mr. Ingalls, as chairman of the commercial programme, and in doing so paid him an excellent tribute for the success he had achieved in conducting the commercial sessions.

The paper by R. S. Orr, of Pittsburg, on "Isolated Plants," was read next.

This subject was prepared by Paul H. Bate, F. B. Carter, T. I. Jones, R. B. Mateer, J. T. Maxwell, Joseph McKinley, R. C. Niles, Jr., and H. Spoehrer, under the editorship of R. S. Orr. Two only of the papers were presented, those by F. B. Carter, of the Boston Edison Company, and J. T. Maxwell, of the Philadelphia Electric Company, the others being crowded out for want of space. The following is an abstract of the views set forth regarding the various methods adopted by the central stations in preventing the installation of isolated plants, or in removing them when once installed. The question is entirely one of cost, whether it will be cheaper to generate current or to buy it from the central station. The solution of the question is often difficult because of the complicated conditions imposed by the business in which the user of current is engaged. It is more often difficult because of the lack of data upon which to base calculations. In the first situation the case can be met by a thorough and systematic study of the conditions by well-trained experts; the second by establishing a proper system of records, where the business is a going concern, or, by securing the data from other establishments where the conditions may be reasonably assumed to be similar. The average manufacturer or merchant has usually not had the training, nor, if he had, could he give the solution of this question, however important it may be, the necessary time and attention to arrive at a correct conclusion. It will be necessary for him, therefore, to secure either the services of an expert to do this work for him or to depend upon the results obtained by a study and investigation of the conditions of his business by the representatives of his local central station. In either event the statements of comparative costs applying to the business in question must be made clearly, accurately and absolutely truthful. To qualify with the prospective customer as an expert, the representative of a central station must, of necessity, have some knowledge of electrical engineering and of the engineering of steam heating. He must understand the principles of operation and the best practice in the operation of steam engines and gas engines, and he must be familiar with the best methods of illumination and of the latest and best practice in the application of power to machinery. Moreover, he must be able to marshal his facts and arguments with such clearness and force as to compel the acceptance of his conclusions by the prospective consumer. The two papers presented were

representative of the others and of the ways of applying the above principles in practice.

The speakers who took part in the discussion of this paper were Messrs. McKinley, McAlpin, Peck, Jones, Lloyd, Mueller and Richter. Most of them pointed out that natural gas at low rates was the most formidable ally of the isolated plant. A general demand for the collection of accurate isolated-plant costs was expressed as of the highest value in showing up the relative advantages of central-station service.

S. M. Bushnell, of Chicago, then read his paper on "Central-station Operation of Steam Plants in Connection with Central-station Service."

Mr. Bushnell treated his subject simply in its relation to the competition between central-station service and that of the independent isolated plant. The argument most frequently advanced in favor of the independent plant—that of the necessity of a large boiler equipment for heating, which could be run at high pressure for light and power purposes, using the exhaust steam for heating—was fallacious, at least in part, inasmuch as in most plants only a comparatively small amount of exhaust steam is used throughout the year for heating purposes. The Commonwealth Edison Company of Chicago had covered such a contingency as this by forming an auxiliary heating company, "The Illinois Maintenance Company," which would make a clean-cut blanket proposition to furnish steam and hot water to buildings on a reasonable flat-rate basis, while the parent company looked after the electric installation and service. In Exhibit A at the end of the paper a description is given of the method of estimating contracts for steam heating. Exhibit B gives the typical form of contract. The methods of making these contracts and the organization for looking after them was discussed in detail. Two visiting engineers are given a free hand in employing local engineers and firemen, and report to the manager, who in turn reports to the vice-president. Examples of plants of various large Chicago buildings under the control of his company were then explained at some length by Mr. Bushnell. The plant of the Railway Exchange Building (which is situated at the northwest corner of Michigan Avenue and Jackson Boulevard) supplies steam not only for its own building, but also for a number of other buildings within a radius of two blocks, including the Nepeenauk Building, Orchestra Hall, Wellington Hotel, the Karpen, Masury and Yale buildings. In conclusion the author vouchsafed his opinion that in the intelligent solution of the heating problem lies the only salvation for the central-station company in meeting the conditions and requirements of the modern large buildings now being erected, and that the competition of the block-lighting plants can be most successfully met through the installation of block-heating plants.

Paul Mueller discussed the subject at length and narrated his varied experiences in supplying heat from a central station. Recently much success has been achieved in this line. One of the most essential elements to successful development of this business is to take care of the heating installation on the consumer's premises. The meter basis for charging has been worked quite satisfactorily; in fact, the old flat-rate basis should not be considered.

B. J. Denman said the business district of Detroit has been completely covered by a district heating system, as has also a considerable area in the high-class residence district. To meet the requirements for high-pressure steam in the business district, the low-pressure lines were paralleled by 100-pound lines, as it was believed at that time, and the experience of three years has confirmed the correctness of the belief, that a strictly low-pressure steam would be of little value in increasing the income from sales of current. Among the buildings in the downtown district which have been secured, is the fourteen-story Pontchartrain Hotel.

Arthur Williams declared that the tendency at the present time is toward structures of larger size in all cities of the country. The isolated plant, so far as any one building is concerned, is equal to a competing central station. Every effort is made to prevent a competing company from getting a franchise, and the same fair motive should actuate us in trying to prevent the installation of private plants in large buildings in the territory of the company. Undoubtedly, the secret of the solution of the problem of getting this service must begin with the heating question. We must have in our service competent steam engineers who can determine the amount of steam-plant capacity necessary to supply heat under all conditions, and then tell the cost of operating the plant, and finally the company should be prepared to back up its estimates with proposals to operate the steam plant, should such operation be necessary.

J. C. Brooks said the Philadelphia company has done considerable steam heating, both from a central heating plant, and by the operation of isolated steam-heating plants. The former practice is carried on in a limited territory, and live steam is delivered to a steam-heating system from boilers operating an electric plant. The method of supplying steam has, however, the advantage of making it possible to compete with the isolated plant, and when a definitely fixed figure per square foot of radiating surface per season is in vogue, the only variable which the consumer has to consider is the use of light and power, the steam heating being definitely fixed.

Davis S. Boyden said that during the past winter he had visited and observed the operation in several cities of district steam-heating plants, and it was a decidedly noticeable fact how few were the isolated plants in operation in the territory covered by the heating companies' mains, even where the lighting and heating companies were operated independent of each other.

John F. Gilchrist declared that for a good many years the owners of large buildings have taken a pride in having their own plants, but that we will see very shortly that fashion change, and before many years it will be acknowledged that the really modern up-to-date building will use the central-station service and that the plant will be found in the older buildings.

The next and last paper presented was entitled "The Effect of Various Conditions of Maintenance on the Efficiency of Illumination," by A. L. Eustice, of Pittsburg.

The author cited the great contrast that is evident to anyone who has made a study of laboratory illumination tests and commercial illumination tests. The conditions met with in most laboratory tests are practically the ideal conditions under which the unit tester should be installed. On the other hand, tests made of commercial installations show the results achieved under actual working conditions, which are very far from the ideal, not only in the matter of the proper selection and assembling of sockets, shade holders and reflectors, but also as to the cleanliness of the entire illuminating unit. An exhaustive study has been made by Mr. Eustice of the actual illumination found in a great many commercial installations of various types of lighting units. The results of a few of these tests were given to show the marked decrease of illumination obtained from lighting units in particular that make use of reflecting glassware, due to the generally unclean condition of the same. No type of lamp is free from this decreased efficiency due to uncleanliness, but certain types making use of smooth glassware showed but comparatively small loss of efficiency. The author closed his paper by emphasizing the importance of keeping the lighting unit clean, and showed by means of tabulated figures depending upon the cost of current how frequently the lamps ought to be cleaned.

In discussing the paper, E. L. Elliott said the neglect to properly care for lighting installations, especially in the matter of cleaning glassware, is one of the most difficult problems confronting illuminating engineers, and the production of such data as Mr. Eustice gave will be of material use in mitigating an almost universal evil. The reduction in efficiency of prismatic reflectors by the accumulation of dust is especially important in view of their very extensive use. While it is true that visible particles of dust on the prism side would have little or no effect on their reflecting power, there is always a certain amount of finer dust and even liquid condensation which forms a film upon the surface which makes optical contact, and so interferes with the reflection. The importance of actual washing is therefore apparent. The question of what may be considered a reasonable and fair average of lighting condition may assume legal importance where lighting units are maintained under contract, as in street lighting. In the Colorado Springs controversy the arbitrators were embarrassed by not being able to find any data whatever. It is to be hoped that the necessarily slow and laborious investigations to which Mr. Eustice has given much careful attention may be largely extended by other investigators, and the results made obtainable to the lighting fraternity.

The concluding meeting of the convention then adjourned.

Convention Notes.

As usual, there were the many little parties given by the old-timers to their friends, many pleasant chair-rides along the boardwalk and visits to the numerous amusement resorts, constituting the unofficial entertainment of the delegates and guests. The entertainment provided by the entertainment committee was certainly enjoyed by everyone present. Sailing parties from the Inlet Pier were taken each day during the week, and the evening sessions gave a number of those who were otherwise busy through the day an opportunity of listening to some of the best papers presented.

One of the corners of the European dining room at the Marlborough-Blenheim on Thursday was the scene of a very handsome testimonial luncheon that was given by N. F. Brady, Thomas E. Murray and Arthur Williams, of New York, to the electrical press of New York. Twenty-five gentlemen in all sat down, and the luncheon was partaken of by at least eight past-presidents of the Association; there would have been nine present, but for the fact that Jas. I. Ayer could not be found in time for this function. The luncheon was entirely informal, but toasts were drunk to the newspaper men and President Eglin.

Among those present were W. H. Blood, Jr., H. M. Edwards, Thomas E. Murray, John F. Gilchrist, T. C. Martin, N. F. Brady, Robert A. Carter, Robert A. Carter, Jr., E. W. Rice, Charles R. Huntley, Charles W. Price, Henry L. Doherty, Charles L. Edgar, Samuel Insull, W. C. L. Eglin, J. M. Wakeman, Thomas M. McCarter, J. R. Lovejoy, Dudley Farrand, Arthur Williams, Judge E. A. Armstrong, A. J. De Camp, Frank W. Smith, W. W. Freeman, Frank W. Frueauff and W. J. Lifton.

The exhibit of the meter committee was particularly complete and attracted a great deal of attention.

As usual, Miss Edith M. Meyers was the moving spirit in getting order out of chaos at the Registration Bureau. Things go along so well in this department now that nothing short of perfection is expected.

Of course, there were a great many old timers, but of those who were present at the first convention of the Association in January, 1885, we noticed only Frank S. Terry, of the National Electric Lamp Association, and Charles W. Price, editor of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.

President W. C. L. Eglin was host at a dinner in the Forest room at the Marlborough-Blenheim at seven o'clock Wednesday evening. Mr. Eglin's guests were: Frank A. Vanderlip, president National City Bank, New York city; Anthony N. Brady, president New York Edison Company, New York; N. F. Brady, vice-president New York Edison Company, New York; Samuel Insull, president Commonwealth Edison Company, Chicago; Charles L. Edgar, president Edison Electric Illuminating Company, of Boston; Joseph B. McCall, president Philadelphia Electric Company, Philadelphia; C. A. Coffin, president General Electric Company, New York; George S. Graham, Philadelphia; Thomas N. McCarter, president Public Service Corporation of New Jersey, Trenton, N. J.; Henry L. Doherty, president Doherty Operating Company, New York; Lewis B. Gawtry, vice-president Consolidated Gas Company, New York; Everett W. Burdett, Boston; George Urban, Jr., Buffalo; Charles R. Huntley, president Buffalo General Electric Company, Buffalo, and Dudley Farrand, general manager Public Service Corporation of New Jersey, Newark. After dinner the gentlemen all adjourned to the meeting hall of the Convention, where Mr. Vanderlip and Mr. Graham each addressed the Association.

The baseball game on Wednesday afternoon was one of the most interesting features on the entertainment programme. The Western team, managed by Frank W. Frueauff, defeated the Eastern team, managed by F. A. Vaughn. Both teams put up a fine sample of baseball, and it was anyone's game until in the seventh inning, when a batting rally gave the game to the westerners.

Dalgleish played a fine game at third base for the Western team, making some almost impossible stops and getting the balls over to the first base in lightning fashion. Glaze pitched a fine game, and Dodd pulled down a couple of long flies to deep center which would have caused trouble, if they had gotten away from him. Cudmore did noble work behind the bat and was later relieved in the last inning by Dodd. Wiley was always safe and helped to win the game by his good work in the infield.

Vaughn held down first bag for the Eastern team for the first five innings, and played a good, heady game. MacMasters, at shortstop, distinguished himself. Hitchner put up a fine game behind the bat and Garrett pitched like a winner all through.

There was only one accident and this happened to one of the really best players in the electrical fraternity. L. P. Sawyer went in to relieve Cudmore in the fifth inning and was struck by the first ball pitched, splitting his little finger and receiving a nasty wound. Sawyer was game and an automobile was commandeered by Henry L. Doherty and a surgeon sewed up the injured digit. No tendons were broken and there was no dislocation, so that it is expected that the damage will be entirely repaired very soon.

The batting order and score follow:

WESTERN WINNERS.

	R.	H.	P. O.	A.	E.
Dalgleish, 3b	2	2	2	0	0
Wiley, 2b	0	0	1	5	0
Dodd, cf. and c	1	1	0	0	0
Brooks, 1b	2	1	13	0	0
Ward, ss	0	0	1	0	1
Scott, rf	1	0	1	0	1
Manley, lf	1	1	0	0	0
Cudmore, c. and cf	0	0	3	1	1
Glaze, p	1	0	0	2	4
Totals	8	5	21	8	7

Sawyer injured.

EASTERN ELECTRIFIERS.

	R.	H.	P. O.	A.	E.
Kennedy, 2b	1	1	2	2	0
McMaster, ss	1	1	1	1	0
Hodgson, 3b	0	0	0	0	0
Agnew, cf	1	1	1	0	1
Hitchner, c	0	0	5	0	0
Garrett, p	0	0	0	3	2
Vaughn, 1b	2	2	9	0	0
Davidson, cf	2	2	0	0	1
McCreery, rf	0	0	0	0	0
Totals	7	7	18	6	4

SUMMARY.

West	2	0	0	4	1	0	1	—8
East	0	0	0	2	2	0	3	—7

The Café Chantant on Thursday evening was greatly enjoyed, many parties being made up and occupying the small tables, where covers were laid for six. The vaudeville programme was rendered by a number of high-class artists and a generally good time was indulged in.

MEETING OF EXHIBITORS.

A meeting of the exhibitors and their representatives was held on Wednesday when Frank H. Gale, chairman of the exhibition committee, made a very satisfactory report. Mr. Gale called attention particularly to the successful outcome of the plan to combine the opening reception ball with the opening of the exhibition. The report of the treasurer, H. M. Post, showed that the finances of the exhibition committee were in good condition. Walter Neumuller, secretary of the exhibition committee, presented the annual report. The number of square feet provided for the present exhibit was 10,800, compared with 3,650 in 1908. There were 68 exhibitors, as compared with 41 last year, and 83 booths provided as compared with 61. Of the booths provided 100 per cent were sold, as compared with 80 per cent last year.

Mr. Gale and Mr. Doane were elected to succeed themselves on the committee. H. W. Young, of the Central Electric Company, Chicago, was elected a member of the committee, and H. G. McConnaughy, of the Dearborn Drug and Chemical Works, was elected a member of the committee to succeed Benjamin Wall for the unexpired term of two years. The election of officers resulted as follows: Chairman, F. H. Gale; treasurer, H. M. Post; secretary, Walter Neumuller; all re-elected.

THE EXHIBITION.

The exhibition committee, under the direction of F. H. Gale, chairman, and Walter Neumuller, secretary, had all arrangements complete on the opening night and the auditorium of the Million-Dollar Pier presented a magnificent array of electrical and kindred appliances. Small apparatus was exhibited in profusion and many new devices were shown for the first time. The uniform scheme of booth arrangement, the absence of large signs or placards and the lighting scheme created an ensemble which was pleasing in the highest degree, and, at the same time, afforded opportunity for careful examination of all of the material displayed.

The Albert and J. M. Anderson Manufacturing Company made an exhibit devoted principally to time switches of various types and sizes and of high-tension switches up to 3,000 volts and 200 amperes. The company was represented by Ernest Woltmann, George B. Crane and A. Anderson.

The Allis-Chalmers Company's exhibition was in charge of C. A. Tupper. Among the things exhibited by the company were: a sample board showing the construction of the blading of an Allis-Chalmers steam turbine; the well-known Type AL transformers; portable air compressor mounted on an ordinary four-wheel platform truck; induction motor; Type K direct-current motor; and a rack containing views of Allis-Chalmers installations of prime movers. Represented by President W. H. Whiteside; M. C. Miller, assistant to the president; A. H. Whiteside, manager steam and electrical department; J. R. Jeffrey, assistant manager steam and electrical department; W. H. Powell, chief electrical engineer; and district managers, salesmen and engineers, including F. C. Randall, George Baiz, C. A. Burns, Harry Byrne, W. G. Clayton, J. T. Cunningham, H. W. Dennison, J. F. Dixon, A. N. Libby, W. C. MacEwen, A. P. Peck, A. F. Rolf, Geo. C. Dresser, W. O. Taylor, L. L. Willard, H. W. Rowley, E. T. Pardee, J. H. Waterman, St. John Chilton, J. B. Nicholson, S. H. Payne, H. H. Pease, E. I. Van Doren, J. C. M. Lucas, A. A. Hutchinson, J. L. Watson, J. F. Shipp, Seldon Jones, B. Moore, O. C. Ross, J. W. Gardner and L. M. Harvey.

The American Electrical Heater Company exhibited a number of standard electrical heating devices for industrial and domestic use. Represented by B. H. Scranton and R. Kuhn.

The American Electric Lamp Company showed a complete line of carbon, tantalum, tungsten and metallized-filament lamps in all sizes. Represented by L. F. Johnson and C. J. Purdy.

The Anderson Carriage Company, Detroit, Mich., exhibited its roadster type of car and also a four-passenger coupé. Represented by Gordan D. Fairgrieve and E. W. Allen.

The American District Steam Company, Lockport, N. Y., exhibited a model of its underground steam mains, showing various fittings, etc.; also condensation meters, live steam meters, both of the Holly and St. John type, and models of various steam specialties manufactured exclusively by the company. Represented by Wm. H. Wells, president; H. J. Babcock, engineer; W. J. Kline, traveling representative; H. C. Kimbrough, manager western office; Robert Hall, treasurer; J. A. Bendure and Miss Rosemond Shankel.

The Baker Motor-Vehicle Company, Cleveland, Ohio, exhibited a Baker Queen Victoria, also a runabout in service for demonstrating purposes. Represented by Emil Gruenfeldt, chief engineer, Peter Dumont and O. B. Henderson, sales manager.

The Benjamin Electric Manufacturing Company exhibited a number of display boards and samples showing its line of wireless clusters and lighting specialties and new tungsten fixtures represented by B. G. Kodjbanoff, G. C. Knott and H. E. Watson.

The Columbus Buggy Company, Columbus, Ohio, exhibited two electric vehicles—Models 1001 and 1202. Represented by R. S. Fend, superintendent electric department, and L. H. Estep, in charge of electric sales.

The Broc Carriage and Wagon Company was represented by J. B. Stueber and J. H. Janssen.

The Commercial Truck Company made an extensive exhibit, showing its two-and-one-half-ton brewers' truck, equipped with a four-motor, four-wheel drive. Represented by L. A. Tirrill, E. S. Hare and E. R. Whitney.

The Crocker-Wheeler Company, Ampere, N. J., exhibited a collection of photographs showing its various products, including direct-current motors, induction motors, power and lighting transformers, etc. Represented by R. N. C. Barnes, manager Boston district office; Rodman Gilder, secretary; R. J. Randolph, sales engineer.

The Dearborn Drug and Chemical Works, Chicago, chemists on the treatment of boiler waters, and manufacturers of high-class lubricants, made its usual interesting exhibit. Represented by Robert F. Carr, president; G. W. Spear, vice-president and eastern manager; H. G. McConnaughy, manager for New Jersey, and Paul T. Payne, manager Philadelphia office.

Dossert & Company, New York, exhibited a number of improvements and new applications of special interest to central station and substation engineers. H. B. Logan, president, and H. S. Shope were in attendance.

The Duncan Electric Manufacturing Company, Lafayette, Ind., had in operation integrating wattmeters, including graphic recording and indicating instruments. The company has lately developed a portable rotating standard test meter, simple in construction, which was shown operating in circuit with an ordinary service wattmeter, illustrating the use of the new meter. Another type of wattmeter, new and novel in its application, was the Duncan lamp-comparison meter, showing at a glance the comparative consumption of ordinary, metallic-filament and tungsten lamps. Represented by Adrian Tobias, sales manager, and Wm. H. Sinks, salesman for the central and eastern states.

The Duplex Metals Company exhibited copper-clad steel wire in sections of billets, showing the reduction from the original size down to the finished product. Represented by J. Kinder, Frank R. Chambers and J. B. Given.

The Economical Electric Lamp Company exhibited its various styles of turndown lamps, working these so as to show their utility. The new turndown tungsten lamp, which consumes thirty-five watts in the tungsten filament and eight watts in the carbon filament, attracted a great deal of attention. Represented by M. and L. Lobenthal.

The Electric Cleaner Company showed the attractive portable "Positive" electric cleaner. Represented by J. M. Roger, C. C. Richardson and A. B. Cousin.

The Electric Storage Battery Company, Philadelphia, Pa., exhibited various types of storage battery cells in which central-station people are interested. For example, the largest cell in the world, consisting of 131 type "H" Exide plates, having a capacity of 22,000 ampere-hours, was shown. This is one of the 150 cells recently contracted for by the New York Edison Company and makes the thirty-second battery installed in New York and Brooklyn. Alongside of this cell was shown the smallest cell which the company makes, namely: a type "L-T," having a capacity of one-and-three-fifths ampere-hours. A large map showing the distributing system for Exide material throughout the United States indicates that approximately 600 centers have been established at which Exide material can be readily purchased by the owners of electric machines. Another interesting device is an exaggerated meter showing the current consumed by a vehicle motor on various grades. Represented by Charles Blizard, third vice-president; Frank Stone, manager Boston office; R. B. Daggett, manager San Francisco office; G. H. Atkin, manager Chicago office; E. L. Reynolds, manager Pennsylvania sales office; H. B. Gay, manager Cleveland office; Albert Taylor, manager New York office; H. H. Seaman, manager Atlanta office, and H. B. Marshall, contract agent St. Louis office.

The Electric Suction Sweeper Company, New Berlin, Ohio, exhibited two different sizes of the Hoover electric suction sweepers, namely, the twelve-inch size for use in the homes and the eighteen-inch machine, which is especially designed for commercial use. Represented by W. H. Hoover and A. W. Wasey.

The Excess Indicator Company made a very interesting demonstration of its apparatus, which automatically throws on a lamp circuit a bad flicker if any attempt is made to use a wattage in excess of that for which the circuit is lamped. The company also exhibited a new low-voltage transformer, for low voltages down to fifty-two volts in residence and commercial lighting. Represented by Bernard Gaines, sales manager.

The Fibre Conduit Company, Orangeburg, N. Y., exhibited samples of its different types of conduit and fittings. Represented by F. A. Curtis and J. M. Nelson, Jr.

The Fort Wayne Electric Works, Fort Wayne, Ind., exhibited the different forms of its single-phase meters, as well as its multiphase meters, also switchboard meters of the single-phase type. In this connection there were shown two sizes of potential transformers; one size of current transformer used with switchboard wattmeters; one Type KM-1 calibrator, used for calibrating meters in service; a special meter testing board, arranged for testing of meters, so that every central station can be equipped to operate its own meters accurately; pedestal commutator-truing devices, complete; Type A standard transformers; a number of small power motors of the various sizes from one-one-hundredth to one-sixth horsepower, for both alternating and direct current; larger type motors from three horsepower to five horsepower. A special device was also exhibited, known as the "Compensarc," which is a special auto-transformer device for use with moving-picture machine arc lamps. A special switchboard for use in operating this compensarc so as to show relative comparisons was also a part of this equipment. One each of the standard line of fan motors was shown. Represented by F. S. Hunting, sales manager and treasurer; A. A. Serva, assistant sales manager and assistant secretary; J. C. Lott, manager New York office; T. L. Sturgeon, manager Philadelphia office; H. W. Smith, manager Boston office, C. A. Woolsey, agent, Philadelphia; E. H. Porter, engineer and salesman, Philadelphia; J. B. Mills, engineer; T. W. Behan, salesman, Philadelphia office.

The Fraley Hand Vibrator Company exhibited its vibrator, which is used extensively in barber-shops and massage parlors. The vibratory movement is effected by the hand through a flexible shaft. Represented by Chas. M. Schunck.

The General Compressed Air & Vacuum Machine Company exhibited a portable cleaner in operation. Represented by A. R. Thomas.

The General Electric Company made one of the striking exhibits, including a collection of tungsten lamps of various sizes, a number of electric heating and cooking devices, including the new leaf unit flatiron and radiant toaster, and a number of other devices using the calorite heating element. Several arc lamps of new types were shown, together with magnetite arcs, calcium carbide lamps, flaming arcs and small size intensive arcs. The exhibit of aluminum-cell lightning arresters attracted a great deal of attention and much interest was manifested also in the company's demonstration of transformer development. The G. E. oscillating electric fan was also exhibited. The company was represented by C. D. Haskins, manager lighting department; D. R. Bullm, manager supply department; P. D. Wagoner, manager transformer department; F. G. Vaughan, manager meter sales; A. D. Page, manager incandescent lamp sales; E. E. Gilbert, manager turbine sales; C. W. Stone, assistant engineer lighting department; Theodore Beran, manager New York office; E. D. Mullen, manager Philadelphia office; F. W. Boyer, assistant manager Chicago office; T. P. Bailey, assistant manager Philadelphia office; Frank H. Gale, in charge of advertising department; F. W. Wilcox, assistant manager incandescent lamp sales; W. H. Coleman, supply manager, Chicago; A. D. Bobson, supply manager, New York; H. C. Houck, supply manager, Cincinnati; J. Scribner, manager lighting department, Chicago; H. C. Glaze, Denver; George L. Thompson, supply manager, Philadelphia; C. B. Burleigh, Boston, and H. J. Buddey, Philadelphia.

The General Vehicle Company exhibited a two-ton chassis, with the body jacked up so that the motor could be shown in operation. Represented by Day Baker, J. H. Vail, J. H. Hanson and R. McA. Lloyd.

G. M. Gest exhibited various materials used in underground construction, including vitrified tile duct, cable racks and the reinforcing butt used in reinforcing metal poles by the New York Pole Company. The steel bars are fastened at one end in a basket, which is dropped into the butt of the pole and then cement grout is forced by compressed air around the reinforcing bars and up into the hollow of the pole. It is stated that at the curb line, where the point of greatest weakness is located, the pole is

strengthened by this process to be far more stable than the original. Represented by H. H. Stannard.

The Griscom-Spencer Company exhibited Reilly multicoil feed-water heaters, grease extractors and evaporators. Represented by J. B. Spencer and Messrs. Michals and Jarvis.

The Habirshaw Wire Company, New York, exhibited various samples of Habirshaw rubber-covered wires. Represented by J. B. Olson, secretary.

The H. W. Johns-Manville Company, New York, exhibited a complete line of the new "Noark" fuse and service boxes, with interchangeable conduit fittings and entrance hoods. Two 13,200-volt fused switches designed for the protection of transmission lines were exhibited for the first time. An interesting feature of the exhibit was the "Noark" interchangeable service meter-sealing system, which provides for the installation of any number of meters feeding from a single service, which in turn is protected by a "Noark" service box. The exhibit also contained specimens of "Linolite" tubular lighting, both carbon and tungsten filaments, reflectors for show-window and showcase installations, picture lighting, weatherproof outlining material, and a variety of desk and table lamps; Victor combination meters; porcelain high-voltage transmission insulators; asbestos wood for high-voltage transformer and busbar compartment protection; indurated fiber oil-switch tanks; "Immovable" guy anchors; friction tapes and splicing compounds; high-tension strain insulators, and a variety of other fireproof and insulating materials of interest to central-station managers. Represented by J. W. Perry, manager electrical department, New York; T. L. Barnes, assistant manager electrical department, New York; H. M. Frantz, manager electrical department, Chicago; Geo. A. Saylor, manager electrical department, Milwaukee; H. M. Voorhis, manager electrical department, Philadelphia; S. G. Meek, salesman electrical department, New York; Robert Charles Cole, electrical engineer, Johns-Pratt Company; R. C. Buell, assistant secretary, Johns-Pratt Company.

The Metropolitan Engineering Company exhibited a comprehensive line of meter protective devices manufactured under the Murray patents. There were also shown a number of other porcelain specialties and the usual display of enameled reflector units and signs. Represented by R. R. Mann.

The Nernst Lamp Company, Pittsburg, displayed a complete line of the new Westinghouse-Nernst lamps. One of the latest developments of the Westinghouse-Nernst system is the new spring type of holder, the design of which makes it applicable to lamps of the old type. There were also shown the new single-glower lamp, the new universal cluster, ornamental multiple-glower lamps and universal chandeliers of the art nouveau, renaissance and composite types. Represented by W. D. Uptegraff, vice-president; Max Harris, general sales manager; Charles A. Barton, manager New York office; Garrett F. Hom, manager Philadelphia office; J. H. Gardiner, manager Boston office; J. B. Mitchell, manager Baltimore office; Otto Foell, chief engineer; A. L. Eustice, illuminating engineer; J. O. Little, manager of publicity department, and S. P. Wilbur of the engineering department.

The Novelty Incandescent Lamp Company exhibited its new 220 and 250-volt any-position tungsten lamp and its regular line of carbon-filament lamps. Represented by R. K. Mickey and R. B. Burlew.

The Philadelphia Electrical and Manufacturing Company showed a new line of tungsten street-lighting fixtures, malleable line materials, cut-outs and fuse boxes.

The Pittsburg Reinforcing Pole Company displayed its method of reinforcing wooden poles. Represented by R. S. Orr, president; Wm. A. Donkin, vice-president; J. W. Murray, treasurer, and W. A. McCoombs, sales manager.

The Pittsburg Transformer Company, Pittsburg, Pa., exhibited a complete line of the new Pittsburg transformers, together with parts of the same. The new Pittsburg transformer has been tried out during the last year and a half and arrangements are now complete in regard to production in quantity of the entire line from 0.6 to fifty kilovolt-amperes. Represented by H. G. Steele, R. V. Bingay, P. H. Butler, C. R. Lininger.

The H. B. Camp Company, New York, exhibited samples of its vitrified clay conduits and also some photographs of installations where this duct is used. Represented by C. C. Baird, western sales representative, and R. P. Keasbey, eastern sales manager.

The Pettingell-Andrews Company and the Price-McKinlock Company, Boston, had a joint exhibit. The Central Electric Company, Chicago, also made its exhibit at the Price-McKinlock Company booth. There were shown a full line of P.-M. specialties, including the well-known devices for the protection and control of customers' services, the P.-M. remote-control switch, meter-connection blocks, O.-K. fuse-block covers, O.-K. ground clamps, and the new high-efficiency "Opalux" reflectors. The Pettingell-Andrews Company showed D & W fuses, Okonite rubber-covered wire, O.-K. weatherproof wire, Wheeler street fixtures, Locke insulators, "Opalux" tungsten fixtures, "Opalux" reflectors, Macbeth glassware, Tungstometers and Peerless tungsten lamps, and the new Metropolitan seal. F. S. Price, secretary; W. J. Keenan, manager of sales, and G. E. Palmer, electrical engineer, represented the Pettingell-Andrews Company.

The Rauch & Lang Carriage Company exhibited a Stanhope car, equipped with twenty-four cells of Exide batteries. The company also maintained a local garage for demonstration. Represented by C. L. F. Wieber, vice-president, and J. H. Kilius.

The Ricker Manufacturing Company, Rochester, N. Y., exhibited meter and service boxes, which are designed to prevent theft of current, also to enable the testing, or changing, of meters without interrupting the consumer's load; oil-fuse boxes, for alternating-current, high-voltage systems; cable junction box for direct-current distribution underground; divided service box, for interior feeders, and acting as tie line. Represented by George Hearn, president.

The Federal Electric Company, Chicago, Ill., exhibited samples showing its general types of signs and a small exhibit showing the various types of tungsten clusters which it is now making. Also a sample board of specialties and a small exhibit, illustrating the working of the "dim-a-lite" and a miniature model of a ground-plate installation and a vacuum cleaner. Represented by James M. Gilchrist, general manager, and H. E. Brinckerhoff and J. J. Magee, from the New York and Philadelphia offices of the Federal Sign System, Electric.

The John A. Roebling's Sons Company distributed literature describing its flexible heater cord, fireproof cable for moving-picture machines and other samples of wires and cables. Represented by W. P. Bowman, G. W. Swan, F. W. Harrington, W. L. Doyle, J. G. Lee and A. V. Errickson.

The Sangamo Electric Company, Springfield, Ill., exhibited Sangamo wattmeters, type "D" for direct current, and type "F" for alternating current; also as a special feature the new Sangamo ampere-hour meters for storage-battery work, for use on electric automobiles, electrically-lighted trains, etc. Represented by R. C. Lanphier, secretary.

The Simplex Electric Heating Company exhibited a very comprehensive line of electric heating and cooking devices. Represented by J. I. Ayer, E. B. Stebbins, R. P. Ingalls and Roger Williams.

The Southern Exchange Company exhibited samples of poles, cross-arms, railroad ties and lumber; showing also a number of large photographs of the company's yards and stocks. Represented by E. G. Chamberlain and W. B. Mitchell.

The Spencer Turbine Cleaner Company exhibited a five-horsepower vertical direct-driven two-sweeper demonstration outfit. Represented by E. W. Muzzy, R. B. Smith, G. H. Noble and S. W. Bowerman.

The Minerallac Electric Company, Chicago, exhibited a Chicago printing attachment for meters in operation, a cable joint showing Minerallac methods of making a perfect joint on high-tension cable, samples of voltmeter switches, reverse-current relays, speed-limit devices, testing adapters, emergency outfits and electroscopes. Represented by Frank Kinney.

The Standard Electric Accumulator Company, New York, exhibited a battery of twenty-three cells on a rack which is turned out especially for elapse-time machines. Different sizes of cells from ten to 200 amperes were exhibited to show how these batteries are manufactured; also sparkers and elements for electric vehicles. Represented by C. DeWaal, secretary and treasurer, and J. Joseph Shaughnessy, sales engineer.

The Standard Underground Cable Company, Pittsburg, Pa., exhibited samples of a number of the complete line of lead-covered cable terminals for indoor and outdoor use; and cable-junction boxes for use in manholes with single conductor and multi-conductor lead-covered cable, a sample of the same type of junction boxes which the company has been furnishing quite extensively in Central and South America for use with steel tape-armored cable laid directly in the ground, instead of installed in the ordinary duct system, such as is used in this country. Also a number of samples of special types of cable as well as sections of joints made with the special insulating tubes for the jointing of high-tension cables. Represented by F. C. Cosby, Boston sales manager; J. R. Wiley, assistant manager New York office; C. J. Marsh, manager New York office; H. P. Kimball, New York office; T. E. Hughes, manager Philadelphia office; W. H. Marsh, assistant superintendent of construction, and Charles W. Davis, general superintendent of construction.

The Star Electrical Concern exhibited a new flame arc lamp which is a decided novelty. The lamp is one-and-five-eighths inches in diameter and the lamp base is of the standard Edison type, allowing the arc lamp to be screwed into the ordinary Edison socket. Represented by W. H. Gardiner and A. W. Young.

The Stave Electrical Company exhibited both its alternating-current and direct-current arc lamps. A new type of vertical-feed arc lamp was shown and an attractive display of miniature lamps was also in evidence. The vertical-electrode flame arc lamps burn three in series on 110 volts, each taking 350 watts. Represented by T. Stave and J. J. Batterman.

The Studebaker Company exhibited pleasure and commercial vehicles, including its latest victoria phaeton. The chassis of this vehicle was furnished with three body models—the victoria phaeton, landaulet and coupé.

The booth of the Engineering Depart-

ment of the National Electric Lamp Association showed the various types of incandescent lamps manufactured by the member companies of the association. From a four-sided arch construction a dome was supported, completely outlined with small low-voltage tungsten sign lamps. Suspended from these arches were several types of tungsten regular Meridian type lamps, equipped with the latest forms of high-efficiency Holophane reflectors. The interior of the booth was furnished in a uniform style of woodwork adapted to the exhibition cases, tables and furniture. The separate exhibits showed the processes of manufacture of tungsten lamps. The several sizes of street series and multiple lighting lamps with corresponding Holophane reflectors were exhibited on one rack, while the different sizes of multiple lamps were shown with a wattmeter connected. A large four-sided case contained an exhibition of all standard sizes of Gem, tantalum and tungsten lamps and many regular and special types of carbon, tantalum, tungsten miniature automobile and train-lighting lamps for several classes of service. P. F. Bauder, assisted by R. F. Strickland and G. S. Merrill, was in charge of the exhibit.

The Wagner Electric Manufacturing Company, besides showing one of its well-known single-phase and one polyphase motors, exhibited an operating model of the Wagner single-phase motor centrifugal device. The device was so mounted with commutator, shaft and bearings, but without rotor or stator spider and windings, that by connecting it with another operating motor, its action would be observed. The Wagner delegation included the following: F. N. Jewett, sales manager; W. A. Layman, vice-president and general manager; Walter Robbins, assistant general manager; E. W. Goldschmidt, New York manager; John Mustard, Philadelphia manager; Brooks Faxon, Boston manager; Dean Emerson, Cincinnati manager; E. H. Cheney, Chicago manager; Alfred Collyer, Montreal manager; Ray D. Lillibridge, advertising manager; J. A. Nelson, of the advertising department. There was exhibited at the convention for the first time a new and important scientific achievement, the Wagner "Moralometer," a direct-reading instrument indicating the morals of an individual.

The C. J. Toerring Company exhibited a line of enclosed arc lamps, a diffusing inverted arc-lighting system, and flaming-arc lamps.

The Tungstolier Company exhibited a very handsome standard, made up of substantial bronze pedestals of the box renaissance type, in cloister finish. From the center of the standard a folding tungstolier was operated, showing the way in which this fixture can be wired complete and assembled directly without tools or auxiliary appliances. Represented by E. J. Kulas, president, Milton Hartman, R. B. Basham and H. L. Parker.

The United States Light and Heating Company exhibited National battery plates for central-station use, for vehicle batteries, and for train-lighting sets, and also a complete line of sparking batteries. Represented by C. C. Bradford, Bertram Smith, John A. White and J. Allen Smith.

The Waverly Company exhibited a motor-driving system and a number of photographs of its electric vehicles. Represented by H. H. Rice and W. C. Johnson.

The Woods Motor Vehicle Company exhibited a coupé and a victoria and also a unit motor frame. Represented by F. J. Newman, W. S. Cramner, J. C. Bartlett and C. J. Metzger.

The Yawman & Erbe Manufacturing Company exhibited central-station record-filing systems. Represented by E. S. Babcox.

The Electric Sterilizing Machine Company exhibited a practical and very interesting ozonizing machine. It is claimed that one machine will keep a twelve-room house supplied with fresh air. The apparatus consists essentially of an air condenser, a high-tension brush discharge being taken off from a series of needle points interposed between adjacent sectors of glass. The air is forced through the ozonizer by an ordinary electric fan. Represented by Russell Spalding.

The Western Electric Company exhibited both alternating-current and direct-current motors; arc lamps of all types, including the Hawthorn flaming arc; fan motors, both alternating-current and direct-current, including desk, ceiling, oscillating and telephone-booth types; a complete intercommunicating telephone system in operation; pole-line material; American transformers; charging rheostats for automobiles; D & W fuses; Deltabeston wire, and Habirshaw wire. The following were in attendance: H. R. King and C. A. S. Howlett, Chicago; O. D. Street, M. A. Oberlander, E. W. Rockafellow, F. M. Dusenberry, H. M. Post, New York; F. D. Killion, R. M. Morris, Pittsburg; J. R. Gordon, Atlanta.

The large exhibition booth of the Westinghouse Electric and Manufacturing Company occupied a central position, employing a decoration scheme of a pergola covered with grape vines. The booth illumination was carried out with various sizes and types of Westinghouse tungsten lamps, ranging from five to 250 watts, including the new five-watt, four-candlepower tungsten sign lamps. Series tungsten lamps for street lighting were exhibited, with both the paper cut-out and adjuster-socket types of hanger receptacles. Forty, fifty and eighty-watt metallized-filament lamps were also shown. The Cooper-Hewitt Electric Company exhibited its latest mercury-arc lamps in the Westinghouse booth. Westinghouse mercury-rectifier sets were shown for storage battery and other small direct-current work. Storage batteries and parts were exhibited by the Westinghouse Machine Company. The motor display included a full line of shunt and compound-wound direct-current, and single, two and three-phase alternating-current apparatus. A small motor-generator set was used in demonstrating the operation of graphic recording meters, embracing a line of power, current, voltage, frequency and power-factor measuring instruments, Westinghouse portable and switchboard instruments, circuit-breakers, switches and choke-coils were also exhibited. The display of electric conveniences included electric sad-irons of various types, introducing the new, rounded, pressed-steel toe, tailor's goose irons, new electric toaster-stove, hot plate, glue and chocolate warmers, luminous and non-luminous electric radiators, sewing machine and fan motors, etc. The following Westinghouse men were present at the convention: Westinghouse Electric and Manufacturing Company—W. M. McFarland, acting vice-president; C. S. Cook, manager railway and lighting department; C. B. Humphrey, manager detail and supply department; G. G. Griffin, assistant manager detail and supply department; H. P. Davis, manager of engineering department; Geo. W. Bates, Charles Wahn, Boston; Samuel Chase, M. C. Rypinski, New York; W. P. Jend, W. B. Wilkinson, Pittsburg; John D. Mickle, Syracuse; W. Clegg, Jr., St. Louis; R. D. Nye, Cleveland; C. R. Gilliland, Cincinnati; J. W. Busch, W. P. Pinckard, Chicago; Lane Schofield, Baltimore; E. C. Means, Denver. Westinghouse Lamp Company—Walter Cary, general manager; T. G. Whaling, assistant general manager. Westinghouse Machine Company—E. H. Sniffin, sales manager; L. L. Brinsmade, Wm. G. Davis, New York; H. P. Childs, Philadelphia; H. H. Van Blarcom, Pittsburg; W. H. Worgorhorst, Cleveland; C. C. Chapelle, Chicago; D. C. Arlington, Pittsburg. Cooper-Hewitt Electric Company—Chas. B. Hill, vice-president; J. B. O'Shea, New York. Nernst Lamp Company—Max Harris, sales manager.

The W. B. McVicker Company, through the courtesy of W. B. McVicker, president, distributed a large number of handsome and costly souvenirs to members of the Association and their families. An art display was made at the Marlborough Blenheim, this collection of rare and odd objects from the art centers of the old world being disposed of to a number of fortunate ones.

The Wagner Electric Manufacturing Company distributed to the ladies of the convention a fine box of candies, and the consumption of these bore out the label which decorated each box as follows: "Wagner, Quality."

Among the manufacturers and representatives not making exhibits, but in attendance, were the following: G. W. Armstrong, Excello Arc Lamp Company; G. W. Allen, Atlantic Electric Sign Company; S. Briggs, American Electric Lamp Company; B. S. Barnard, president Standard Underground Conduit Company; James G. Biddle, American Instrument Company; Caxton Brown, Weston Electrical Instrument Company; D. J. Burns, Ward Leonard Electric Company; Frank G. Bowles, Allis-Chalmers Company; Arlington Bensel, Driver-Harris Wire Company; J. S. Codman, Holophane Company; S. B. Condit, Jr., Condit Electrical Manufacturing Company; H. N. Cosh, Columbia Incandescent Lamp Company; L. J. Costa, Jandus Electric Company; R. W. Charles, Otis Elevator Company; H. H. Cudmore, Brilliant Electric Company; Francis E. Donohoe, American Electrical Works; W. E. Evans, Hemingray Glass Company; G. M. Haskell, Safety Insulated Wire and Cable Company; Albert C. Hofrichter, F. W. Wakefield Brass Company; E. H. Haughten, Bryan-Marsh Company; H. F. Holland, Pacific Electric Heating Company; J. H. Hallberg of New York; H. P. James, Cutler-Hammer Manufacturing Company; M. M. Kohn, International Electric Meter Company; P. S. Klees, Franklin Electric Manufacturing Company; A. O. Kuehmsted, Gregory Electric Company; George C. Knott, Benjamin Electric Manufacturing Company; B. J. Codjbanoff, Benjamin Electric Manufacturing Company; G. G. Lockwood, Bryan-Marsh Company; V. R. Lansingh, Holophane Company; C. S. Howe, Holophane Company; P. W. Miller, Kerite Insulated Wire and Cable Company; A. J. Mitchel, Adams-Bagnall Electric Company; C. J. Marsh, Standard Underground Cable Company; P. S. Millar, Electrical Testing Laboratories; W. B. McVicker, W. B. McVicker Company; George T. Manson, Okonite Company; Romaine Mace, Okonite Company; W. H. Marsh, Standard Underground Cable Company; Converse D. Marsh, Bates Advertising Company; N. L. Norris, Banner Electric Company; James B. Olson, Habirshaw Wire Company; E. H. Peck, Phœnix Glass Company; George F. Porter, Atlantic Insulated Wire and Cable Company; J. G. Pomeroy, Adams-Bagnall Electric Company; H. C. Rice, General Incandescent Lamp Company; Charles C. Smith, Standard Paint Company; L. P. Sawyer, Buckeye Electric Company; W. S. Sisson, D & W Fuse Company; B. G. Tremaine, National Electric Lamp Company; G. A. Thompson, Adams-Bagnall Electric Company; A. J. Thompson, Excello Arc Lamp Company; H. B. Vanzwoll and H. M. Vanzwoll, National Electric Lamp Association; H. E. Watson, Benjamin Electric Manufacturing Company; H. W. Young, sales manager Central Electric Company.

ELECTRICAL INSTALLATIONS FOR TRANSATLANTIC LINERS.

BY ALBERT H. BRIDGE.

Few subjects in the electrical engineering domain promote discussion or receive attention in the meetings of British electrical engineers less than does that of electrical installations on board ship. In the case of a public power-supply system on land or some large industrial installation there is less restraint imposed in the matter of publication of descriptive particulars by powers in authority, while there is generally on the part of designers of such installations, as well as manufacturers responsible for their execution, a recognition of the beneficial effects derivable from their confrères knowing something about their latest work. But when one comes to deal with electrical work carried out for the British Admiralty, or say for the large ship-owning companies, one meets a different attitude altogether. In the case of the latter companies there may be thought to be no occasion for publicity and no benefits obtainable therefrom so far as they as owners are concerned, though both of these are ideas that are easy to controvert. Respecting the former, not only may there be no occasion for publicity recognized, but there may be quite legitimate reasons why secrecy should be desired and ordered. And so it comes about that seldom does the subject of electrical work on board the British ships of war receive more than a superficial attention, the large electrical staffs employed at the dockyards and the officials responsible on board for electrical duties not being permitted to write about things in more than the most general way were they even disposed to do so. Sometimes a firm which has supplied a certain plant to a number of vessels will let the details of this be known, but much of the more important and interesting information is more or less a closed book.

In the case of the great liners there is of course less occasion for reticence, and this has now and again led to the publication of valuable matter regarding the manifold ways in which electricity is today being applied in adding to the efficiency of working as well as the safety, comfort and convenience of passengers on these gigantic floating palaces.

So rapidly do we move in this matter of ocean-going vessels, particularly in transatlantic liners, that the magnificent performances of the Lusitania and the Mauretania have become almost commonplace. But to the electrical engineer the contemplation of such magnificent undertakings is far more than that, for he knows that they each contain an installation larger than is operated for the light and power supply of many a borough, and in some respects more varied in its examples of electrical application than any land installation of any mansion or hotel, however costly or complete. By the courtesy of W. C. Martin, of Glasgow, whose firm was responsible for the electrical installation on board the Mauretania, the writer is enabled to give illustrated particulars of the system. The firm has carried out some of the chief installations of a similar character, though on a smaller scale for other ships, but this may be regarded as the most representative and comprehensive example of British electrical equipment on board passenger-carrying ships.

Before proceeding to detail this piece of work, however, some reference may be made to a paper which has just been read before the Newcastle Section of the Institution of Electrical Engineers on "The Electrical Equipment of Liners and Battleships," by A. P. Chalkley. This author says that the electrical portion of a ship is always considered so far as a minor affair, and it has to be made absolutely safe even if it involve greater expense; thus it comes about—whether the precaution be necessary or unnecessary need not be discussed now—that up to the present there is "probably not a single ship with a voltage supply of more than about 120 volts." Yet on a large new liner the cable costs $100,000, whereas by doubling the voltage some $25,000 could have been saved on this item alone. The objections against higher voltage are stated thus:

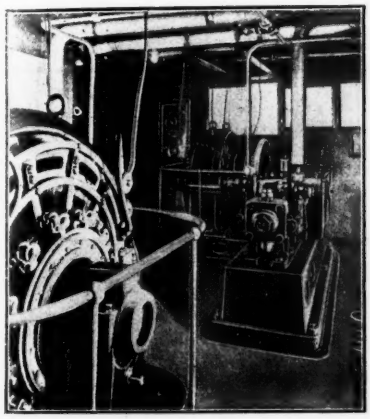
(1) The difficulty of maintaining good insulation in any cables or switches exposed to the action of sea air, leakage being especially liable to occur in plugs and switches on the upper decks, and this increases rapidly with a higher voltage.

(2) Many of the minor appliances in warships cannot be satisfactorily worked above 110 volts.

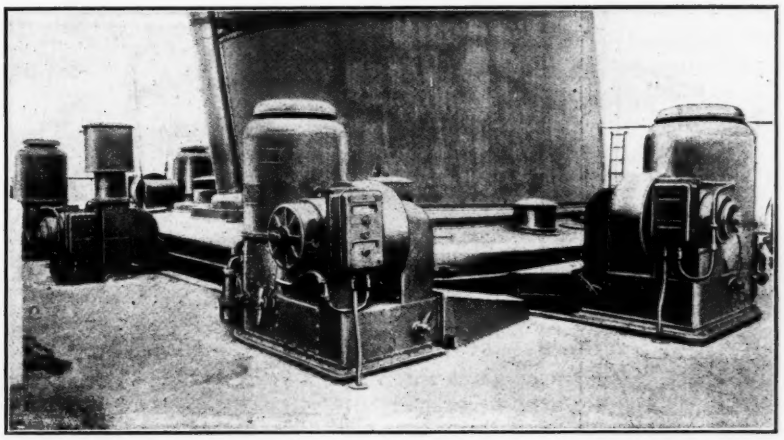
(3) Lamps above 110 volts have delicate filaments that do not last so well as those of lower voltage, and renewals in the ordinary way constitute a very serious item.

(4) There is more danger of fire and risk to person, especially as at sea so few precautions are taken by those responsible for the electrical plant and men totally unused to and ignorant of electrical gear are frequently set to operate it.

Mr. Chalkley mentioned that one of the newest battleships is to be equipped on a three-wire system with 220 volts between the outers, the lighting being at 110 volts and the motors working on 220 volts. If this is satisfactory it will be adopted generally in the British navy, and eventually it will be followed by

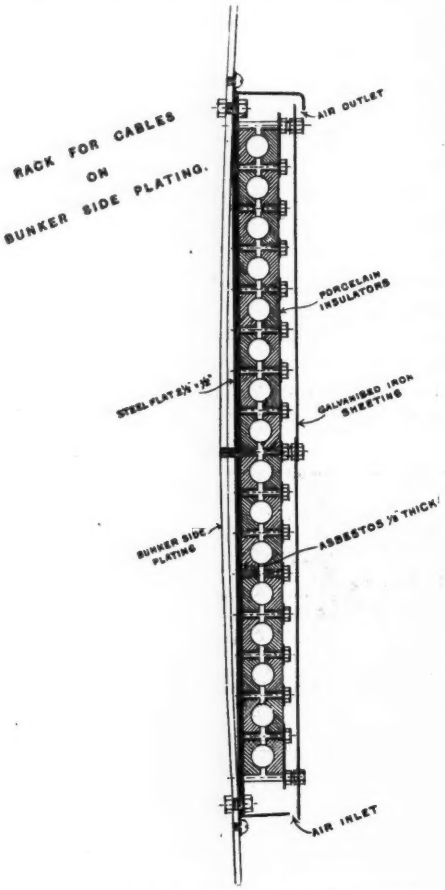


REFRIGERATING MACHINERY.



MOTOR-DRIVEN FANS FOR THERMOTANKS.

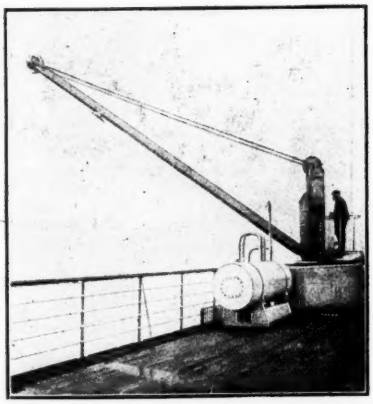
builders of passenger boats "who do not care to have much variation from Admiralty practice." In regard to the question of generating plant, when the total output does not exceed 500 horsepower there is possibly not much to be gained by using turbo-generators instead of reciprocating engines, but "when it is from 1,000 to 2,000 horsepower the adoption of turbines is distinctly advisable." In some of the most recent boats the plant has (as have also the switchboards) been subdivided into two equipments in separate compartments, between which is a watertight bulkhead, the only communication being through the bulkhead door. For warships where the machinery is below the water level and liable to be flooded, this arrangement is particularly valuable, as by closing the watertight door and opening the disconnecting switch the load can be taken over by the plant remaining intact. Passenger boats often possess elaborate slate panels on which the switches, etc., are mounted, but nearly all battleships have everything fixed to angle bars forming a sound though possibly inartistic piece of work.



METHOD OF FIXING AND PROTECTING CABLES.

The switches are bolted to the bars, from which they are well insulated by mica or micanite, so that no shock, however severe, would dislocate any portion of the equipment. With a slate base, heavy firing accompanied by severe vibration might cause the slate to smash and damage some of the circuits, and if it is used it must be firmly bolted to the angle bar. It should be of several sections and not merely two or three panels, so that one portion could break without doing vital damage to the whole plant.

In the Mauretania and Lusitania some of the feeders have to carry as much as 1,000 amperes, and the use of fuses is inadvisable, so specially designed overload circuit-breakers with time-limit relays have been employed, and, it is said, with much satisfaction. These relays are of the Ferranti wattmeter type, in which a small motor winds up a cord over a drum, a weight being attached to the end of the cord, which making contact with a stop after rising a certain height operates the trip. The panels were designed to Admiralty requirements and they have reverse-current relays for the main generator switches, since the machines run in parallel on single positive and negative busbars. The board for the Lusitania followed battleship lines so far as feeder panels were concerned, as no slate base was used, and the switches were fixed directly on to an iron framing; but on the Mauretania a complete slate board was put in, which consisted of many segments, each bolted separately to the angle irons and firmly stayed against the bulkhead behind. The use of only two busbars, Mr. Chalkley said, was something of an innovation for ship work, where, as a rule, there are a common negative bar and separate positive bars for each generator.

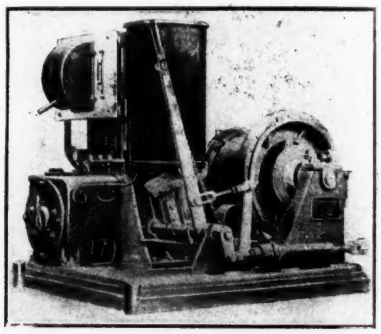


1,350-POUND ELECTRIC JIB CRANE.

Lighting, which formerly predominated in the electrical installation on a ship, is now frequently of minor importance as far as the power required is concerned. On the Lusitania 350 horsepower is the maximum power needed for lighting purposes, but the motors aggregate some 2,000 horsepower.

Mr. Chalkley at one point in his paper discussed briefly the subject of the electromechanical propulsion of ships. There were various systems, but electrical propulsion before it became general had much to combat. The many turbine systems and arrangements and the combination of reciprocating engines and low-pressure turbines all have their advocates and all seem full of promise. "We can only hope," he said, "that the electrical system will have an equally good trial and not be allowed to fall for lack of practical proof of its merits."

Turning now to the Mauretania installation, we are provided with the following facts by Mr. Martin, who described the work before the Institution of Engineers and Shipbuilders in Scotland last year. The total cost of the installation on each of the latest Cunarders has been about $325,000. The total output of the four electric generators is about 2,200 horsepower, while the actual power required for all the lights and motors running at one time is 2,773 horsepower. It is found in general practice that the power being very intermittent, two generators are capable of doing the work. To find space for such a powerful plant and to fit the installation on the safest and most reliable system presented interesting problems. The Cunard Company adopted the steam turbine because of the small space occupied and the less weight and more freedom from noise or vibration as compared with ordinary high-speed engines.



ELECTRIC WINCH FOR HOISTING AND LOWERING LIFEBOATS.

There are four sets of Parsons continuous-current turbo-generators, each dynamo being shunt-wound and capable of

giving an output of 3,750 amperes at 110 volts and 1,200 revolutions per minute. These generators are placed on an elevated platform abaft the engine room, in two separate compartments, as already mentioned. Mr. Martin considers that a better arrangement for them would have been to place them nearer the center of the ship, but being a vulnerable part, the Admiralty required them to be placed below the water line, hence the reason for placing them so far aft.

One part of the switchboard is in the port generating room, the other being in the starboard generating room.

Each board has two generator panels, twelve feeder panels, and one disconnecting panel. Normally the two switchboards are connected together as one board through the disconnecting switches, but may be separated in a moment from either room, and each side of the ship operated as a separate installation.

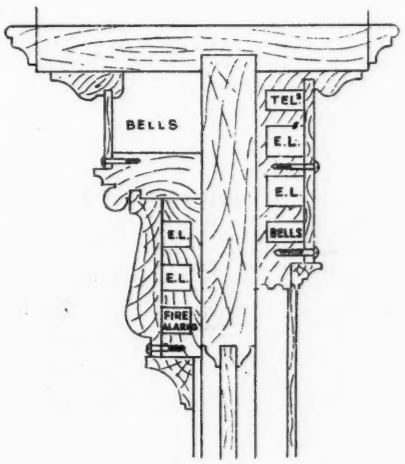
The circuit-breakers are of massive construction, the contact surfaces being pressed firmly together by levers. The make-and-break contacts are massive carbon blocks, at the extremity of the switch arms, and the main circuit-breakers are so arranged that the flash at breaking takes place in fireproof compartments well clear of the attendant. To accomplish this object and to make the operation of the switches easy, the handles are placed below and connected to the switches by insulating links behind the board. These switches are held in the closed position by engaging with a trigger which may be released either by hand or by a trip coil.

In order to prevent the opening of the circuit-breakers during a momentary overload, a relay is introduced which closes the trip-coil circuit when an overload occurs, after a period adjustable up to fifteen seconds. Should, however, a reversal of current through the generator take place, the relay promptly closes the trip-coil circuit, and thus cuts the machine out of circuit. The opening of the circuit-breaker in turn breaks the trip-coil circuit, and prevents damage to the coil or waste of energy.

The feeder switches are operated in a similar way, but without the reverse-current arrangement. They have, however, in addition, a trip coil in series with the main current, adjusted to open the circuit with a greater current than the relay is set to operate at, but instantaneous in action. Thus, should a short-circuit or heavy overload occur and the relay fail to operate, damage to the cables and machinery is effectively prevented.

The relay is simple and reliable in operation. It consists of a small motor, similar to that used in meters, through which part of the current is shunted. This motor tends to wind a strong silk cord on to a drum against the pull of a weight fastened to the other end of the cord. The cord passes round a drum, to which the contact arms are fitted. When the current exceeds the overload limit, the torque of the motor is sufficient to wind up the cord, and thus close the trip-coil circuits. The adjustments are affected by altering the weights and varying the distance between the contacts.

All the ammeters and voltmeters are of the moving-coil type, the former being operated from shunts in the main circuits. By this means it is possible to have the reading instruments in any convenient



R. M. S. MAURETANIA, FIRST-CLASS ACCOMMODATION—MAIN DECK. ARRANGEMENT OF CORNICES TO RECEIVE ELECTRIC WIRES.

place, and in the Mauretania two instruments are fitted for each machine, one being in the port and one in the starboard room. On each board, one additional ammeter is fitted, connected to bars behind the feeder panels, and so arranged that it may be connected by a plug to any one circuit at a time. By this means the current in any feeder may be ascertained without the expense of separate instruments for each circuit. Two station voltmeters and two paralleling voltmeters are provided, and the shunt regulators, which are placed behind the boards, are operated by a hand wheel on the front.

The Cunard Company, with its usual precautions for the comfort and safety of its passengers, decided that a high voltage would not be advisable, which accounts for the current being generated at only 110 volts. This necessitated cables of a great carrying capacity, and also very heavy switch gear and other material. The double-wire system is used throughout, and there are forty-eight main cables of about two inches external diameter running from the generating station to the various sections of the ship. The power is divided into twenty-four substations of approximately 100 horsepower each, twelve of these being on the port side of the ship and twelve on the starboard side. Eight of these stations provide power for forced draft fans, two to supply the engine-room machinery and two for engine-room lighting, the remaining twelve being connected to auxiliary switchboards at convenient distributing centers throughout the ship.

These twelve auxiliary switchboards are placed directly opposite each other, port and starboard, and cross-connecting cables are fitted so that, in the event of one section failing, the supply can be maintained from the other side. It should be mentioned here that, as the motors are only used intermittently, there is always sufficient surplus carrying capacity in the cables to provide for emergencies of this nature, thus guarding against any total extinction of the light.

The auxiliary switchboards are fitted in fireproof chambers, principally on the main deck. The switches are single pole, and the fuses double pole—Mr. Lackie's patent zinc fuse—which breaks circuit with a minimum flash. Each board is provided with a spare panel containing spare fuses ready at a moment's notice.

From these auxiliary switchboards, vulcanized rubber cables are carried in wood casings to section fuse boxes, which again provide distributing boxes at convenient positions for supplying the lights, the wires being run without joints. These cables running from the main deck to the different sections above are like the trunk of a tree, with branches spreading out to the different decks. Special precautions were taken to keep all positive and negative wires in separate grooves.

In the corridors the casings are arranged so that all wires are accessible at all times. In all the rooms of the ship the frieze forms a covering to the electric casings. A special feature of this is to be seen in the lounge, library and smoking room, and all over the ship the wires are accessible. No fuse boxes have been fitted, but all fuse panels are built in specially arranged recesses in the paneling, the panel itself forming the door; a door is also fitted behind for access to the wires. Inside the door, a tablet or card is fitted, giving information of

what each branch supplies, with size of fuse.

In the wiring of engine and boiler spaces and other parts of the ship exposed to rough work, the protection of the branch wires calls for special treatment. Some engineers think screwed iron conduit or galvanized-iron tubes are most suitable, but experience has proved that tubes sweat and retain condensed moisture, which very soon destroys the best insulation. The best results are obtained with parallel twin conductors, each conductor being separately insulated with pure rubber and vulcanized rubber, braided and bound together, then sheathed with an outer armor of galvanized-iron wire.

This system of armored twin conductors has special advantages for engine rooms and other exposed parts. It is compact, requires less space, and has as strong a mechanical protection as an iron tube, but does not harbor moisture about the insulation as in the case of tubes. When well coated with paint the armoring is further protected from corrosion. It is watertight and fireproof, has no soldered joints, and is always accessible.

In addition to the lighting and power circuits, there are single-core and multiple-core cables for electric bells, telephones, fire alarms, electric clocks, and the Stone-Lloyd system of indicating the position of watertight doors. There are over 200 miles of wire fitted, the copper in which weighs over 100 tons.

There are over 6,300 lamps distributed over the ship, fitted to pendants, electroliers, and brackets of various designs to suit the furnishings of the respective rooms. In the public rooms and state rooms the fittings are of a most handsome design, and the arrangement of concealed lamps for lighting the dining-saloon dome gives a beautiful sunlight effect, while other compartments are brilliantly illuminated with beautiful crystal fittings. A special feature throughout has been to design the fittings so as to obtain reflected lighting from the ceilings as well as from the lamp itself.

In every department of engineering the electrical transmission of power has become almost universal, but on shipboard it has made but little progress. In the latest Cunard steamers, however, there has been a decided advancement. In no other steamship, including the most recent German vessels, can be found anything to compare with the electrical installation on the Mauretania.

The motor installations are given in the following table:

No of Motors.	Aggregate Horse-power.	Purpose.
16	800	Forced draft.
28	276	Ventilating machinery space.
18	400	Auxiliary machinery in engine room.
16	52	Ventilating ship.
53	156	Thermotanks supplying heated air.
4	64	Refrigerating plant.
2	16	Two passenger lifts.
4	108	Life-boat winches.
8	48	Electric jib cranes.
6	78	Mail and baggage hoists.
6	20	Hoists and stores.
2	10	Printing machinery.
1	5	Wireless telegraphy.

In addition, power to the extent of twenty horsepower is consumed for pantry and kitchen service machinery, etc., and eighty horsepower for 106 electric radiators for special staterooms, bathrooms and hospitals—in all, a total of 2,133 horsepower, independent of the power for lighting.

The forced draft for the main boilers is supplied by thirty-two fans arranged in pairs and driven by sixteen electric motors of fifty horsepower each; the motors are of the enclosed type, developing the power at 450 revolutions per minute, with the current at 110 volts. The fan impellers are of the single-inlet type, being sixty-six inches in diameter and each capable of delivering 33,000 cubic feet of air per minute, against a water pressure of three-and-one-fourth inches on the discharge side when running at 450 revolutions per minute. Each fan is provided with a water gauge and tachometer. Each motor is also fitted with a controller or switch capable of regulating the speed in equal increments by field variation from 225 to 450 revolutions per minute. Low-voltage and overload automatic releases are fitted to these controllers, giving complete protection to the motors under all conditions.

When running at the lowest speed the approximate output of air from each fan is 17,000 cubic feet per minute, against a water pressure of one inch. Each fan room is also ventilated by eight single-inlet fans twenty-one inches in diameter, each being driven by a motor of the totally enclosed type capable of delivering 1,000 cubic feet of air per minute against a water pressure of one inch, when running at a speed of 900 revolutions per minute.

The motors are of the four-pole series-wound type, and are each capable of developing normally an output of five horsepower, when supplied with current at a pressure of 110 volts and running at a speed of 900 revolutions per minute. Each motor is supplied with a controlling panel consisting of a one double-pole quick-break switch, tubular fuses, and starting and regulating resistances, the whole being self contained and mounted upon a panel suitable for erection on the bulkhead.

For dismantling the turbines there are six sets of lifting gear, each consisting of a thirty-horsepower motor, driving a horizontal shaft above the turbine, coupled to two seven-inch diameter vertical lifting screws and worm gear, by which means the turbine casing or rotor can be lifted in turn. The weight of the low-pressure rotor is about 125 tons and the high-pressure rotor seventy-two tons, and these can be lifted in thirty minutes.

There are two seventy-five-inch and two sixty-inch sluice valves in connection with the high-pressure turbine exhaust steam, and in each of these is fitted a twelve-horsepower motor operating a worm gear. Each is controlled from switches on the starting platform, where an index shows the action of the valve.

Other electric motors in the engine room are the thirty-horsepower motors for the turning gear and the twenty-five-horsepower motors for the centrifugal pumps, which draw off surplus water from the condensers. For ventilating the engine room there are ten Sirocco fans of twenty-five inches diameter, each driven by a five-horsepower motor, six fans of thirty inches diameter, each driven by a thirty-horsepower motor, and four fans of fifteen inches diameter, coupled to one-and-one-half-horsepower motors.

The general heating and ventilating of the ship are maintained by fifty-three thermotanks, each fitted with a motor-driven fan, the motors varying from two-and-one-half to four horsepower, making a total of 156 horsepower. Each motor fan supplies a section of the ship with warm or cold air, or by arrangement of valves on the tanks, the fans can be made to extract the air from various compartments.

Electric-power driving is also extensively used for deck winches, passenger hoists, and other appliances to the extent of 270 horsepower.

For the passenger lift, two motors of eight horsepower supply the power to the winding gear, while other two motors of fifteen horsepower supply the power for two 4,500-pound baggage hoists, and two five-horsepower motors operate two 1,120-pound store hoists, while two more of one-and-one-half horsepower control the two 225-pound pantry hoists for conveying food from the kitchen. There are

also two mail hoists fitted with twelve-horsepower motors.

In addition to these there are four electric jib cranes, each made to lift 1,350 pounds. The lifting motions are operated by a twelve-horsepower motor through worm gear, and the slewing motion through worm and spur gearing by a two-and-one-half-horsepower motor, the motors being series wound of the enclosed type. These cranes are conveniently placed on the boat deck for lifting stores or luggage and mails from tenders that come alongside.

Another important part performed by electric power is the hoisting and lowering of the lifeboats. This work is done by four electric winches placed alongside the lifeboats. The motors attached to these winches are each of twenty-seven horsepower, connected to worm gear running in an oil bath.

An interesting application of electric driving is in connection with the refrigerating machinery. The two gas compressors are each coupled direct to a twelve-pole shunt-wound motor of thirty-five horsepower, giving a constant torque between forty and 110 revolutions per minute. The armature is provided with two windings which are in series at starting, and by turning the hand wheel on the switch gear, the starting resistance is cut out and a variable resistance inserted in the shunt circuit to regulate the speed between thirty-five and seventy-five revolutions per minute. By transposing the armature windings from series to parallel connections without resistance, and by inserting the shunt resistance again, the speed can be increased to 110 revolutions per minute. The two brine pumps are operated by shunt-wound motors of three-and-one-half horsepower each.

In addition to the large number of motors already enumerated, there are still a great number of other applications. Among these are the motors for driving the printing machine and the Marconi apparatus, of five and three horsepower, respectively, and provision is made by having connections on deck for driving winches of 112 horsepower on the quay or in barges. In the galleys and cooking department an electric motor drives a machine capable of making bread for 3,000 people, and in the cooking ovens there are four vertical spits, driven electrically, capable of dealing with one-half a ton of meat at a time; other motors are fitted to knife-cleaning machines, dish-washing machines, circular knives for cutting bacon, potato peelers, whisking machine, freezing machines for making ice cream, and numerous electric hot plates for keeping food warm during service.

Telephone instruments are fitted throughout the first-class staterooms. Having an exchange on board, passengers can converse with one another without leaving their rooms. On arrival in port the exchange is connected to the Liverpool or New York exchange, so that passengers may be in communication with their homes or offices up till the hour of sailing or immediately on arrival.

Another telephone system connects the captain and officers on watch on the bridge with the engine rooms and crow's-nest on the foremast. These consist of Graham's navy pattern loud-speaking telephones, and are used for docking and steering as well, connections being fitted on the forecastle, in the wheelhouse aft, and in the steering-gear room at the stern of the ship. For the officers' use there is an intercommunication telephone service fitted, consisting of the Parsons-Sloper secret instruments, each officer being able to call up another from his own room.

In addition to the telephone system there is a large installation of electric bells, with Gents' patent indicators. In every first-class stateroom there is a combination fitting of electric bell push, electric-light switch, connection for portable reading lamp or curling-tongs heater, and electric fans, while a number of special rooms are fitted with electric radiators.

A complete installation of electric clocks is fitted on the magnetic system. In the public rooms and principal entrances and corridors there are fitted, in all, forty-eight clocks, controlled from the master clock, situated in the chartroom adjoining the bridge.

There is also a complete electric fire-alarm system. A brass plate and red lamp indicate the position of the alarm push in the corridors, these being connected to indicators in the engine room and the navigating house on the bridge deck.

In addition to the ordinary life buoys, there are two special buoys fitted on the bridge deck, operated by Martin's electric release gear, which can be operated from the bridge and other positions, on the alarm being raised.

In connection with the Stone-Lloyd system of watertight doors, an electric indicator is fitted in the navigating house which shows the position of every watertight door in the ship. The doors are closed or opened by hydraulic power simultaneously, by the officer in charge moving a handle, which operates the control valve. The function of the electric indicator is to show the officer exactly which doors are open or closed. The indicator has a small lamp for each door, with wires led to a contact switch at the door, which, when the door is closed, completes the lamp circuit and lights the lamp.

Another important fitting on the bridge is Martin's automatic indicator for the navigating lamps.

Santa Fe Electrification.

The Santa Fe Railway Company proposes to electrify the line over Raton Pass, a distance of thirty-eight miles, between Trinidad, Colo., and Raton, N. M., in which event 15,000 electric horsepower will be required for twenty-four hours' consumption in hauling freight and passenger trains through the Rocky Mountains.

The change from steam to electricity will involve an expenditure of about $1,500,000, and J. J. Henry, president of the Southern Colorado Power and Railroad Company, of Trinidad, will figure with the Santa Fe officials on a contract to do the work.

Mr. Henry is interested in the Tongue River Power and Transmission Company, which owns a valuable waterpower proposition in the Tongue River Canyon. His company also holds an option on the plant and equipment of the Sheridan Electric Light and Power Company.

New Haven Merger Case in October.

United States District Attorney Asa P. French and Colonel J. H. Benton, Jr., counsel for the New York, New Haven & Hartford Railroad, conferred recently with the judges of the United States Circuit Court, relative to the proceedings in the New Haven merger suit. The court announced that it would be ready to hear the arguments on the demurrer in October. No day was set, but it is understood that the matter will be taken up when all parties interested have returned to the city.

Cement Company's Mortgage.

The Mississippi Valley Cement Company, of Louisiana, Mo., has filed a mortgage deed of trust to the Mississippi Valley Trust Company of St. Louis to secure bonds in the sum of $1,500,000 which will be issued to raise money to pay off its indebtedness and to complete the plant in Louisiana. The bonds will run until July 1, 1929, but are redeemable in 1912 and will draw five per cent interest.

Electrical Notes From Great Britain.

By Our British Correspondent.

The Government of India itself provides a considerable portion of the telephone service of that vast country, and this is held to stand in the way of more extensive development of telephonic facilities there at the present time. At all events, that is the view of the Oriental Telephone and Electric Company, Ltd., an English company, which for many years past has interested itself in telephone concessions in Egypt, China, Japan, Bengal, and other eastern states. This company has sometimes obtained power to introduce a telephone service in various additional centers in India and Burmah, such as Bangalore, Madura and Mandalay, but without the support of government lines and their subscriptions, it has been found that the number of users among the public is not sufficient to justify the installation and maintenance of exchanges. Now, however, there is a brighter prospect, at any rate in regard to the newly created Eastern Bengal province, of negotiations between the telephone company there, the Government and the commercial community, coming to a successful issue leading, it is believed, to the approaching opening of a new field of telephone enterprise there. The Oriental company is very largely interested in the Bengal Telephone Company. Dacca, the chief seat of the Eastern Bengal province, is the center of the Indian jute and hide trades. At Madras, Rangoon, Singapore and Bombay there are also indications of a telephonic revival. The China & Japan Telephone Company is busy in Hongkong and Kowloon, and when the Kowloon-Canton Railway is completed, the company will extend its sphere of activities toward Canton. In Mauritius this company is just now negotiating with the Government for a concession to provide the whole island with a telephone service, instead of serving Port Louis only.

One of the most successful electric tramway systems in the British colonies is that at Auckland, in New Zealand, owned and operated by the Auckland Electric Tramways Company, Limited, whose offices are in London. Auckland has a population of 80,000, and last year with eighty-seven cars working on 22.3 route-miles of track, this entire population was carried nearly 330 times, or approximately once a day. The year's revenue was $830,000, an increase of $126,000 over the previous year. Additions were made to the power-station plant and rolling stock, and further outlay will take place this year, as the power station is to be enlarged, automatic coal-handling machinery and pumps of greater capacity being added, while the repair shops are to be remodeled and the car sheds extended. At the time the undertaking was commenced, it was not expected that the generating and distributing arrangements would be called upon to meet such heavy demands. Many additions have been made from time to time, but it has now been considered that the economical limits of the direct-current generating system have been reached. Therefore, in order to be prepared for the future, a 600-kilowatt, 5,000-volt, alternating-current set is to be put down for transmission to a direct-current substation at Epsom for feeding the southern lines. Although there has been freedom from accidents, the Public Works Department called for a new system of brakes to be adopted on the cars, so two cars are being fitted with the latest improved type of air brake, in order to ascertain whether it will be suitable for Auckland conditions.

Some years ago, when it was recognized that the operation of electric-light and power plants in many of the smaller towns did not give any prospect of being brilliant financial successes if worked by separate boards of directors, several efforts were made by companies securing a number of small concessions to be controlled from one central board. Economies in fees and management expenses, etc., were rightly expected to accompany such a combination. Up to the present, however, for a variety of reasons, the combination principle does not seem to have proved a much greater catch than the separate-working idea would have done. The period has been an exceptional one, if we take, for instance, the Urban Electric Supply Company, Limited, a bosom relation of the disastrous Edmundson's Electricity Corporation. The year 1908 has in all the small towns where this company has plants working, been characterized by three main adverse circumstances: (1) The exceptionally fine weather; (2) trade depression throughout the country; (3) the increased use of metal-filament lamps. It is considered that there must always be a tendency to a seesaw movement in the results shown by any particular town, and the smallness of the business in the case of the smaller towns naturally renders the results peculiarly susceptible to unforeseen and unavoidable fluctuation, such things even as a death or removal or temporary absence of a large consumer, or the slack trade of a power user, going a long way toward turning a normal increase into a decrease. But, as was pointed out to the urban shareholders, it works out better on the average over the whole group of stations, because the volume of business taken together is sufficient to adjust the equilibrium and compensate for the individual fluctuations, thus affording the stability characteristic of a large business. It should be mentioned in connection with these comments that the Urban company has thirteen undertakings, four of which serve towns with populations of less than 10,000, and only three of which have over 20,000. In one of these latter the population consists almost entirely of mill operatives, so that to secure even an extra $500 revenue per annum is no light matter.

Attention has recently been drawn again to the desirability of the electric-supply powers for small places being carried into effect by gas companies already at work. Ascot was the first instance of this kind of thing in England, and, as far as things have gone, very satisfactory results have been obtained. Stephen Sellon, M. I. C. E., in giving evidence before a parliamentary committee in favor of the application by York Town & Blackwater Gas Company for electricity supply powers, said that the association of the two kinds of supply meant all the difference between profit and loss. The promoters were in a better position than a company just starting, for they had joint ownership of land, joint supervision, a collecting staff, the use of energy supplied from producers which were fed entirely by gas coke, and a joint organization for meter inspection and the collection of accounts. All those conditions, Mr. Sellon argued, tended to economy, and he believed would mean something like 1d. per unit on the output. Further, if the two illuminants were in one hand, capital could be more easily raised

where the investor knew that there was a gas revenue on which the electrical part of the undertaking could fall back. No doubt there are many English gas companies which would like to secure possession of the electric-lighting undertakings and powers in their towns if they could arrange their own terms, but there would be opposition rocks to steer past. Competition in the matter has been generally regarded as being a good thing for the consumer, but we imagine that there are some small municipalities which, having done nothing but lose on their electric-light plants from the beginning, would not be difficult to persuade to discuss terms, in spite of the fear of the consumer that he would pay more if one company had things all its own way, and in spite of the probable opposition of Parliament.

At the last gathering of the Institution of Electrical Engineers in London the subject under discussion was economics of medium-sized power stations, the opener being A. J. J. Pfeiffer, who submitted a study of comparisons between steam, gas and oil engines. A short description was given of the principles involved in the modern internal-combustion oil engine, its method of working, and its advantages and limitations from the standpoint of economy of operation as compared with gas and steam engines. The Diesel engine was referred to, as that is the only type of oil engine so far constructed in sizes large enough to be considered a factor in central-station design. Results were put forward showing the superiority of this engine from both the commercial and the technical standpoints, and making it a most important factor in the central-station practice of the future. It was also shown that local Diesel plants can be operated cheaper than a system of a large outlying central station distributing power by means of converting substations. Mr. Pfeiffer thought that central-station engineers should consider the Diesel engine in connection with extensions to existing stations, or in cases where it was a question of supplying power at points so far removed from the main station as to involve heavy additional capital and operating expenditure in connection with transmission and conversion.

In a paper on "Interpole Designs," W. B. Hird, referring to the use of interpoles in machines of comparatively small outputs and at ordinary speeds, said that it was more than "a mere fashionable whim," as the increased adoption of interpoles showed. It is becoming more and more usual for users to specify them once they have had experience of them.

W. Duddell, F. R. S., read a paper on a bifilar vibration galvanometer before the Physical Society on May 14. W. P. Fuller and H. Grace followed with notes on the effect of temperature on the hysteresis loss in iron in a rotating field.

F. G. C. Baldwin has brought before the Birmingham Section of the Institution of Electrical Engineers some considerations in the manipulation of dry-core telephone cables, based upon his experience of actual practice. He described the various operations which a telephone cable undergoes after its manufacture, and illustrated what is done by the National Telephone Company to secure the greatest working efficiency.

The effect of the falling off in orders for generating-station plant consequent upon the progressive adoption of the metal-filament lamps, is referred to in the report of the Brush Electrical Engineering Company. This is one of the earliest English electric manufacturing companies, but its results during the last few years have been extremely unsatisfactory from an investor's point of view. The past year has been a very bad one. Not only has there been a falling off in orders of the kind named, but tramway enterprise has been practically at a standstill in England. The exceptional trade depression has especially affected the engineering industries, and the shortage of orders is stated to have "aggravated the already keen rivalry among home manufacturers engaged in the electrical industry," and "with powerful competition from abroad to contend with in addition, prices have ruled low." The Brush company is taking up a new type of metal-filament lamp. The Fine Cotton Spinners' Association is reported to have placed with the company the electrification of a number of its mills.

Several other electrical manufacturing companies have also issued their reports during the last few days. Johnson and Phillips, Limited, of Charlton, blame the general depression of trade for accounts that allow of no dividend being paid to the ordinary shareholder. Callender's Cable and Construction Company, though deploring the condition of the engineering trade during the past twelve months in every part of the world, is able to pay dividend and bonus of fifteen per cent. It has experienced a restriction of business both at home and abroad, and it expresses its view of the position in the following terms, which are those that many concerns would use just now: "No new undertaking of any importance in the electrical industry was carried into effect during the period under review, the orders secured by the company being confined almost exclusively to extensions of networks and supply stations already in existence."

The position of the British Westinghouse Electric and Manufacturing Company has improved. The turnover for the year has been about the same as for the three preceding years. There was a falling off chiefly in the home market, but export business was maintained. Competition was severe, owing to the reduced volume of business offering. Expenses were further reduced by twenty per cent during the year, so the financial position is stronger. Since the close of the year the orders booked have been slightly in excess of those received up to the same date last year.

Arrangements are in progress for the Students' Section of the Institution of Electrical Engineers to visit the large engineering works of Germany in July. The dynamo works of Siemens and Halske, also the works of the Bergmann Company, the Siemens-Schukert Company, the Allgemeine Elektricitäts Gesellschaft and Dr. Cassirer & Company, are in the programme, as are also the Charlottenburg Technical Institute, the Reichsanstalt, a gas-engine-driven electric station near Cologne, and one of Germany's electric-railway systems. The party leaves London on July 9.

The full subjects are now announced for the meeting of the Municipal Electrical Association which takes place at Manchester and Liverpool from June 21 to 25. S. L. Pearce, city electrical engineer, Manchester, is president, and will deliver the usual address. The subject of "Cheap Units" will be introduced by a Swansea councilor. E. E. Hoadley, chief electrical engineer of Maidstone, will open the important matter, "The Influence of Metallic Filament Lamps on the Electrical Industry and on Street Lighting," which ought to lead to a good discussion. E. M. Hollingsworth, of St. Helens, will introduce "Modern Cable Systems." The other papers will be: "Steam Turbines from the User's Point of View," by A. S. Blackman of Sunderland, and "Notes on Condensing and Water-Cooling Plants," by E. Lunn, of Huddersfield.

ALBERT H. BRIDGE.

London, May 29, 1909.

ELECTRIC AUTOMOBILE MOTORS AND CONTROLLERS.

BY ALEX. CHURCHWARD.

Designers of electric automobiles have usually given their first attention and thought to the battery as the limiting feature both in weight and mileage, as it usually represents the greatest item of expense when maintenance is considered. The battery used in the modern electric vehicle is generally so proportioned that the free-running current of the vehicle on level hard roads is less than its four-hour discharge rate (which is the normal rate of discharge for most types of automobile batteries), the motor, or motors, having a continuous rating to correspond.

Although it is not intended to dwell particularly on a discussion of batteries in this paper, it may be appropriate to point out briefly a few of the considerations that should govern the selection and grouping of cells.

When designing a new vehicle the question arises as to the best voltage for given work, or, in other words, the number of cells of battery to be used. Before this question is decided an analysis must be made of the especial requirements which this vehicle is to meet, and the following points should be kept in view:

(1) It is not desirable to select a battery composed of many very small cells, as experience has shown that a seven-plate Exide cell, or its equivalent, is as small as can be commercially successful in regard to maintenance, stored energy per pound, and space occupied.

(2) The energy consumption per mile of the particular vehicle in question must be carefully calculated.

(3) Charging facilities must be considered, and the location in which the vehicle will ordinarily be kept. Will it always be charged in private plants, with apparatus adjusted for the particular number of cells, or will it have to be charged in public garages, suited only for charging from forty to forty-four cells in series?

(4) Experience has shown in the past ten years that the higher the voltage and lower the current the more efficient the motor and control system will be, but with the highly efficient vehicles on the market today it is not necessary to put in a great number of cells. Repeated tests have shown that the following limitations of voltage are minimum for maximum vehicle efficiency: Forty-eight volts for a vehicle consuming not over 1,450 watts at normal speed on level roads (motor rating thirty amperes); sixty volts for a vehicle consuming not over 2,100 watts at normal speed on level roads (motor rating thirty-five amperes); eighty to eighty-five volts for all vehicles taking over 2,100 watts at normal speed on level roads.

If we could leave out of all consideration the sizes and number of the cells we would then have the following axiom: "The higher the voltage (within a reasonable limit) the greater the vehicle efficiency, both when charging and running."

Vehicle manufacturers who have been in the market for years have realized the above and have already made, or are making arrangements in their latest vehicles to set the limit of the lowest working voltage at forty-eight volts.

An extremely low-voltage motor, twenty-four volts, for instance, can never be made as efficient as a forty-eight or sixty-volt motor. For comparison, in a sixty-volt, thirty-ampere motor and a twenty-four-volt, seventy-five-ampere motor, the copper, iron, bearing friction, and windage losses would be substantially the same in both cases, but the brush-contact loss would be very much greater in the twenty-four-volt motor; also the commutator friction loss would be at least twice as much as in the sixty-volt motor. Few people realize that the losses from brush contact and brush friction are very considerable items in the total losses of a well-designed automobile motor. The result will be, therefore, that the sixty-volt, thirty-ampere motor can be made five per cent to ten per cent higher in efficiency than the twenty-four-volt, seventy-five-ampere motor. This is at normal load only. On heavy grades, and when accelerating, the difference in efficiency in favor of the higher voltage will be still greater.

A few years ago the vehicle manufacturers demanded the lightest weight motor possible, consistent with limited outside dimensions, and at the same time insisted on a very high efficiency at normal load and overloads. The efficiency of the motor or motors alone, at normal load and for overloads is not, however, a dominant factor, for when designing automobile motors the most careful consideration must be given to the necessity of obtaining the greatest torque per ampere at all loads.

With a given free running current a properly designed automobile motor should increase its torque approximately five times, with 2.5 times increase of current. Such a motor will operate well with the battery supplying it on all roads, for it will accelerate the vehicle rapidly without drawing abnormal current, and will be capable of propelling the vehicle up a 7.5 per cent grade without exceeding the same limit, which, again, corresponds to the one-hour rate of discharge of the battery.

A motor, like that described above, must be designed so that the magnetic flux in the armature increases in proportion to the work to be done. Therefore, the magnetic circuits of the entire machine must not be restricted by conditions of design necessitating very limited weight and too scant dimensions, for the

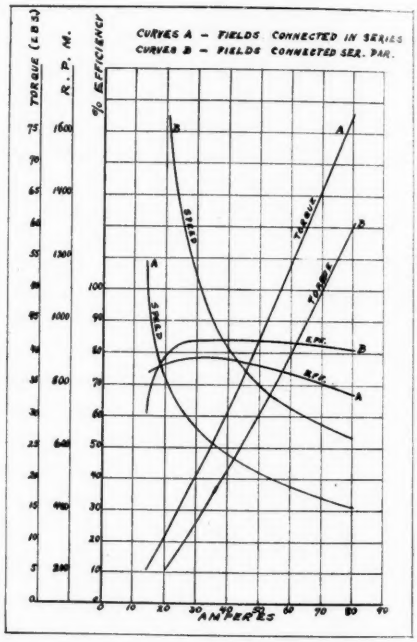


FIG. 1.—CHARACTERISTICS OF SERIES MOTOR.

total torque is proportional to the product of the magnetic flux in the armature, and the ampere-turns on the armature. The turns on the armature being a fixed quantity, the only variables are the magnetic flux and the current.

Many attempts have been made from time to time to use the motor as a generator when coasting or braking, and to charge the battery when so doing. This necessitates a special field winding, and also complicates the connections and the controller. As the result of actual tests in this country there appears to be no gain in using this method at present and under existing conditions of practice. This type of winding necessitates radical changes in the characteristics of the motors which have been already described.

In the present state of the art the best

motor for all-around service is the straight series motor, with a characteristic such as described above and shown in Fig. 1.

Within the last few years the single-reduction motor, mounted on the axle, has been rapidly displaced by the higher speed double-reduction motor, mounted on the body of the vehicle. This type of motor has many advantages over its older rivals, among which are the following:

(1) It is suspended from the vehicle body, consequently there is less wear on tires and gears, due to direct hammer blows when passing over rough roads.

(2) Flexible drive, by chain, between motor and wheels, reduces the losses due to binding of driving parts to a minimum.

(3) The use of spur gears in oil or a silent chain for the first reduction diminishes the noise very greatly and increasees the efficiency. Chain on second reduction can also be enclosed.

(4) Most important of all, by using a higher speed motor, better characteristics can be obtained with the same weight, also higher efficiency at normal load and overloads.

The fact that a light motor does not necessarily enable the total weight of a vehicle to be kept low cannot be stated too strongly. That is to say, if the vehicle has to perform a certain number of ton-miles with a given battery under ordinary service conditions, the properly proportioned, although heavier, motor will consume less energy per ton-mile than the unduly light motor not having the proper proportions and characteristics. Furthermore, the additional weight of battery required to run the very light-weight motor will in most cases amount to more than double the additional weight in a motor properly designed, to say nothing of the greater care and expense of repair and maintenance in the former.

If it were necessary to design vehicles to run on a perfectly smooth, level track only, with a minimum of stops, the light-weight motor would be satisfactory; but in actual service, grades more or less severe are encountered continually, and stops are very frequent, especially in crowded streets.

After a suitable motor has been chosen for any given condition, it is essential that the proper gear-ratio be selected; otherwise, when hill climbing and accelerating, the current consumption will be out of all proportion to the capacity of the battery, and largely decrease the mileage that the battery was calculated to furnish.

Many vehicles on the market today could be improved in their energy consumption per ton-mile, radius of action, and in hill-climbing possibilities, if they were equipped with motors and gearing suited to their weight and speed, and to the batteries with which they are equipped.

Next in importance, comes the method of control. With a properly designed controller, the acceleration from the first notch of the controller to the last, or full-speed position, should be without any break in the circuit, as there is nothing more unpleasant to the operator than being jerked forward and backward as the speed points are changed. Besides personal discomfort, the damage done to the driving mechanism and the tires is often serious.

The continuous torque control developed by the General Electric Company

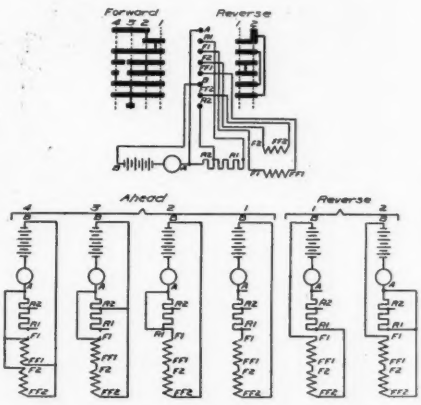


FIG. 2.—DEVELOPMENT OF TYPE S-35, FORM A, CONTROLLER.

for both single and double equipments, meets all requirements of personal comfort and protection to the motors, gearing and batteries. The main features of the system are:

(1) Smooth and efficient acceleration from the first to the last notch of controller.

(2) No arcing between fingers and contacts when going from one notch to the next.

(3) Minimum burning and wear on fingers and contacts.

(4) Evenly divided increments of speed.

The result is that the maintenance of motors, gears, chains, batteries and tires is reduced to a minimum.

The motor and battery connections and the development of the General Electric controller, type S-35, form A, are shown diagrammatically in Fig. 2. This controller is typical of those most extensively used in the latest vehicles.

The Chicago Electric Club.

The regular meeting of the Chicago Electric Club, held Wednesday noon, June 2, was addressed by C. F. Parker, general purchasing agent of the Illinois Central Railroad. Mr. Parker spoke of the harm that had been caused from the excessive amount of government interference with the business of the interstate railroads. In pointing out in detail the effects of this agitation, he stated that one of the most prosperous railroads had had its surplus entirely wiped out last year and that its earnings barely paid the interest on its bonds and the dividends of the stock. He spoke of the general movement now under way to overcome this state of affairs. A broad plan of laying before the public the other side of the question is being carried out. He concluded with an earnest plea that business men in general co-operate in this matter with the railroads, upon whose welfare their own industry is largely dependent.

Electrical Exports for April.

The steady improvement in the total electrical exports from the United States noticeable in the returns for the first few months of this year received a marked setback during April. Both as compared with the preceding month and with the corresponding month last year there is a decided falling off. This is no doubt mainly due to the hesitancy caused by the unsettled tariff situation in this country. As soon as this is cleared up it is believed that export activity will generally be resumed.

As prepared by the United States Department of Commerce and Labor the official statistics on the electrical exports are as follows:

	April, 1909.	March, 1909.	April, 1908.
Appliances	$490,483	$ 681,083	$ 586,427
Machinery	489,026	579,499	566,586
Total	$979,509	$1,260,582	$1,153,013

A list of the principal countries to which electrical products were exported during April, 1909, with the value of these exports, is given below:

Exported to—	Electrical Appliances.	Electrical Machinery.
United Kingdom	$ 36,440	$ 54,276
Belgium	8,103	.....
France	3,390	22,723
Germany	9,975	4,903
Other Europe	5,334	46,933
British North America	132,892	51,896
Central American States and British Honduras	18,275	28,177
Mexico	50,053	65,592
Cuba	40,006	10,976
Other West Indies and Bermuda	3,780	.....
Argentina	22,770	6,431
Brazil	80,263	35,090
Other South America	20,218	3,693
British East Indies	.....	17,367
Japan	23,736	100,944
British Australasia	7,523	6,889
Philippine Islands	14,564	4,971
British Africa	7,286	23,187

Up-to-Date Street Lighting in Aurora, Ill.

Aurora, Ill., a city of 30,000 inhabitants, located thirty-eight miles west of Chicago, has for years been well to the front in the matter of street lighting. It claims the distinction of having been the first city in the United States to light its streets with electricity, and has ever since kept up well in the progress of street lighting.

During the summer of 1908 the "West Side Improvement Club" was incorporated. This was followed by an east side association, called the "Improvement Association of Aurora," and still another east side association, called the "La Salle Street Improvement Association," which was not incorporated, and included the business men of the one street only. Then followed the "Island Improvement Association." These associations and clubs included the entire business section of the city of Aurora.

Matters of better street lighting were taken up with the City Council and an agreement was finally reached whereby the city was to operate and maintain such a suitable system as might be agreed upon by City Electrician C. C. Hinckley and installed under his supervision.

The first cost, outside of the city's regular employes, was to be paid by the respective improvement associations, each taking care of its own section. All agreed that they wanted the tungsten lamps on ornamental posts, and underground wires.

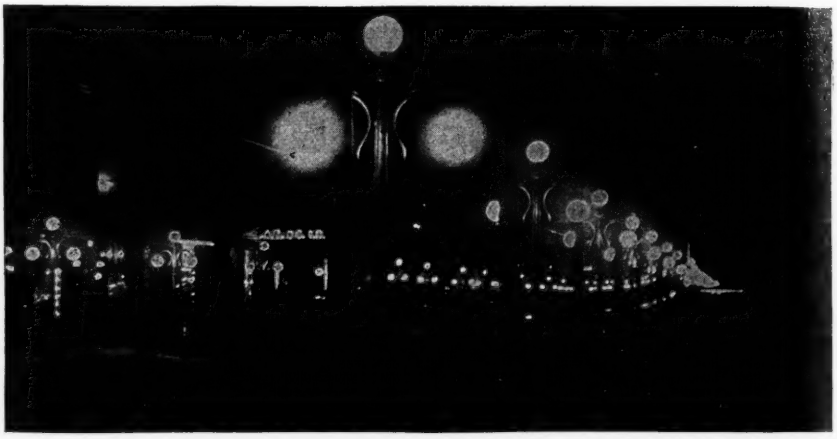
The multiple system of distribution was chosen. This has the advantage of a low voltage at the lamp posts and throughout the conduits, besides eliminating much of the danger of accident from shock. With the multiple system all lamps operate with the same brilliancy, and if a lamp burns out the balance is unaffected. Operated in this way lamps last longer than if connected in series.

The accompanying illustration shows the appearance of one street in Aurora by night.

The lamp posts are twelve feet high to the socket on top. The side arms project two feet on each side. The posts are set 100 feet apart on each side of the street. In all there have been up to this time 257 posts installed through the business section. Most of these were put in operation about the first of December, 1908.

At the street corners there are five lamps to a post, while the rest of the posts have three lamps each. The center light is a sixty-watt tungsten and the side lights are 100-watt tungstens. Out of the 257, forty-four are five-lamp posts, so that in all there is approximately 75,620 watts power used at the present time. All these lamps are operated from 82.75-kilowatt capacity transformers manufactured by the Vindex Electric Company, of Aurora, Ill. The power house is located with the city waterworks, which is two miles from the center of the city. The current is brought to the transformers at 2,300 volts and there reduced to 110 volts.

The transformers have been placed on poles in out-of-the-way places and the heavy low-voltage wires carried down the pole to the conduit. In most of the streets an extra cement curbing was put in, the conduit placed in this curbing, and the ornamental posts placed on the top of the curbing.



NIGHT VIEW OF AURORA STREET, SHOWING ORNAMENTAL TUNGSTEN ILLUMINATION.

At some places the conduit has been placed in the street at the edge of the curbing and special cement foundations provided for the posts. Conduit boxes have been provided at convenient intervals throughout the system.

The city of Aurora has also adopted this system of ornamental tungsten-lamp illumination in a small park that was previously lighted by arc lamps. The park is two short blocks one way and one rather long block the other way, which makes it nearly square. This has been nicely lighted by means of twelve posts placed in two concentric circles. The absence of the very dark shadows that occurred when arc lamps were used is very noticeable.

Harriman Line Electrification.

Harriman engineers are said to be investigating the advisability of electrifying the Central Pacific, Oregon Short Line and San Pedro.

Utilization of Peat.

Col. John Jacob Astor has applied for a patent for a machine, which it is hoped will make possible the utilization of peat deposits as a fuel for power. A recent number of the *Scientific American* contains an account of the process, and says that Colonel Astor intends to present it to the public in the hope that it may be of wide general use.

Colonel Astor turned his attention to disintegrating the substance of the peat, and his device, it is believed, by the utilization of the actual gas and water in the porous peat will split up the peat and allow it to be thoroughly and uniformly heated. In an ordinary internal combustion engine he places the engine muffler inside the gas-producing chamber. The sides of the muffler are thin enough to be drawn in or thrust out according to the pressure of the gas within it.

Broadway-Lexington Subway.

The New York Public Service Commission has asked the Board of Estimate and Apportionment of New York city to approve a modification of the plans for the Broadway-Lexington Avenue subway route, permitting the double-decking of the four tracks between Houston Street and the Harlem River.

This double-decking will reduce the amount of space necessary in the streets and will also reduce the expenditures for real estate where stations are to be constructed.

This last reduction would alone approximate a total saving of $10,000,000, and other economies would also be possible, as the grade in the express tracks will be largely eliminated, it not being necessary to follow close to the surface of Lexington Avenue.

The Seventh International Congress of Applied Chemistry.

(From Our Special Correspondent.)

The inaugural meeting of the Seventh International Congress of Applied Chemistry was held in London, May 27, under most favorable circumstances. The membership of the congress has exceeded all previous records, over 3,000 full members' tickets and 600 ladies' tickets having already been issued. It is probable that the final figures at the end of the congress will show an attendance of 4,000.

The Albert Hall, in which the first meeting was held, contained an imposing and striking audience when the Prince of Wales rose to declare the congress open and to welcome the foreign delegates.

After speeches of welcome from Honorary President Sir Henry Roscoe and Acting President Sir William Ramsey, Dr. Harvey W. Wiley, chief government chemist of the United States, Professor Gautier, of Paris, Prof. Otto de Witt, of Berlin, Professor Paterno, of Rome, and Professor Arrhenius, of Stockholm, replied as representatives of their various governments and nationalities.

The seventeen sections into which the congress is divided met in their various section meeting rooms after the close of the inaugural proceedings, and elected officers and secretaries for the congress.

The London congress will be of exceptional interest to Americans this year, since a deputation of American chemists, led by Harvey W. Wiley, and appointed by President Taft, has gone over to invite the congress to New York in 1912—the gathering being triennial and not an annual one.

The Executive Committee of the congress has decided that all papers shall be printed in advance (in abstract form only), at the expense of the congress, and that an international committee shall be formed to decide, after the congress is over, which papers are to be printed in the proceedings, and whether in abstract or in full. This discrimination between papers of much and little value has been rendered necessary by the bulk and weight of the congress proceedings in recent years, the report of the Rome congress of 1906 extending to seven volumes and weighing with its package forty-one pounds.

J. B. C. KERSHAW.

London, May 27.

[The American invitation to hold the next congress (1912) at Washington, D. C., was accepted. Prof. E. W. Morley, of West Hartford, Conn., was elected honorary president of the 1912 gathering, and Dr. W. H. Nicholls, of New York, acting president.]

Metropolitan Securities Suit.

Argument was made in New York in the United States Circuit Court of Appeals on May 26 on an appeal taken from the judgment entered in the Circuit Court last September for $5,200,000 against the Metropolitan Securities Company in the suit brought against it, by the receivers of the Metropolitan Street Railway Company. The suit was to recover an amount named as a balance due on $8,000,000 of three-year five per cent improvement bonds taken over by the Securities company.

Paul D. Cravath and Delancey Nichol argued on behalf of the Securities company for a reversal of the judgment given by Judge Ward on the ground that the contract between the Securities company and the Metropolitan Street Railway Company and its lessee, the New York City Railway Company, was a loan contract and not a sale contract. It was urged that there never had been any sale outright of the improvement bonds, but that there was an agreement of money advanced as a loan on these bonds as securities.

"When the Metropolitan and the New York City Railway Company became insolvent," Mr. Cravath said, "there were no obligations on the part of the Securities company to make further payments to an insolvent borrower." It was argued further that the notes could not have been sold by the corporation that made them.

Robert C. Beattie, as counsel for Receiver Ladd, in reply, said that the notes in question came within the Wall Street definition of railroad short-term notes, a common form of issue, which were properly salable. "These notes," he said, "have not matured as yet, and when they do, they will be enforced by the holders against the Metropolitan Street Railway Company."

Power Site Withdrawals.

Acting upon the specific instructions of the Secretary of the Interior, the United States Geological Survey has begun the investigation of waterpower sites on the public lands. Since April 23, the date of the Secretary's order, the Director of the Survey has recommended eleven temporary withdrawals "in aid of proposed legislation affecting the disposal of the waterpower sites on the public domain." These power-site withdrawals, aggregating 236,365 acres of public lands in the states of Utah, Colorado, Wyoming, Montana, Idaho and Oregon, have been approved by Secretary Ballinger.

McAdoo Extension Approved.

The Board of Estimate and Apportionment, of New York city, has approved the extension of the McAdoo tubes from Thirty-third Street and Sixth Avenue to Grand Central Depot.

William G. McAdoo, president of the Hudson & Manhattan Railroad Company, says that as soon as the Mayor signs the permit for the extension granted by the Board of Estimate, he will proceed to get the consent of property owners along the route. He expects to get this within six months. In case of failure to do so, he will go to the Appellate Division of the Supreme Court, and get a writ granting the commencement of condemnation proceedings. It will take approximately a year and a half to build the road, and Mr. McAdoo expects within two years to be carrying passengers to Grand Central Station.

Trolley Development in Iowa.

According to the *Times* of Cedar Rapids: "There is no state that needs interurban lines more than Iowa. It is a fact, however, that the pernicious corporation laws made by the Thirty-second general assembly has practically kept capital from the development of interurban lines. Cedar Rapids has two interurban lines instead of several that she ought to have, and doubtless would have had, had it not been for the unreasonable and useless corporation laws that are upon the statute books, and for the purpose of preventing the securing of capital for the development of the resources of the state, and for the additional purpose of giving to a few, salaried positions to perpetuate useless reform schemes which work out to the detriment of the public."

Navy Department Supplies.

The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids, on June 26, for motor-generator sets, exciters, switchboards, etc., for delivery at the navy yard, Philadelphia, Pa.; and for one 1,000 and two 1,500-kilowatt turbo-alternators for delivery at the navy yards at New York, Philadelphia and Boston. Particulars may be had from the Bureau or from the navy yards.

Boston Elevated to Make Improvements.

The Boston Elevated is said to be planning to spend $1,000,000 in enlargements to its elevated station and tracks at Sullivan Square. Plans for the changes are now before the railroad commissioners for approval.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

SCHENECTADY RAILWAY.

The report of the Schenectady Railway Company for the quarter ended March 31, 1909, compares as follows:

	1909.	1908.
Total railway operating revenue	$195,821	$192,828
Total railway operating expenses	145,904	153,381
Net railway operating revenue	$ 49,817	$ 39,446
Taxes accrued	11,672	6,756
Operating income	$ 38,244	$ 36,690
Other income	3,070	1,385
Gross income	$ 41,315	$ 34,075
Total deductions from gross income	22,500	22,500
Net corporate income	$ 18,815	$ 11,575

INTERBOROUGH EARNINGS INCREASE.

Substantial increases in both gross and net income on the subway and elevated lines contained in the Interborough system, New York city, are shown by the report of the Interborough for the quarter ended March 31 last. The figures have been given out by the New York Public Service Commission and show:

MANHATTAN RAILWAY DIVISION.

	January-March, 1909.	Increase Over Corresponding Quarter in 1908.
Earnings from operation	$3,521,230.87	$ 28,922.76
Operating expenses	1,536,728.94	†42,706.88
Net earnings	$1,984,501.93	$ 71,629.64
Other income	139,663.34	21,453.21
Gross income	$2,124,165.27	$ 93,082.85
Deductions, taxes—		
On property used in operation	$ 36,000.00	$ 6,000.00
On earnings and capital stock	50,108.94	503.76
Other than above	300,000.00	35,000.00
Rentals	1,455,293.02	†45,540.35
Net income	$ 282,763.31	$ 97,119.44

SUBWAY DIVISION.

Earnings from operation	$3,321,525.15	$459,400.99
Operating expenses	1,186,884.98	60,389.95
Net earnings	$2,134,640.17	$399,011.04
Other income	222,606.59	22,475.64
Gross income	$2,357,246.76	$421,486.68
Deductions—		
Interest on funded debt	$ 498,812.50	$223,812.50
Taxes on property used in operation	18,000.00	3,000.00
Rentals	*545,957.46	43,187.72
Amortization of discount and expense	3,036.21	3,036.21
Net income	$1,291,440.59	$148,450.25

*Rental due city of New York measured by interest and sinking fund on city bonds for construction of rapid transit railway.
†Decrease.

LONDON UNDERGROUND.

The Underground Electric Railways, of London, report gross earnings for the week ended May 1 and seventeen weeks ended May 1, 1909, compared as follows:

	1909.	1908.
Bakerloo	£ 3,405	£ 3,070
Piccadilly	5,945	5,405
Hampstead	4,010	3,230
District	10,080	8,601
Tramways	5,883	6,220
Total	£ 29,323	£ 26,526
Total seventeen weeks	475,371	442,051

DETROIT UNITED RAILWAY.

The report of the Detroit United Railway Company for the month of April and four months ended April 30, 1909, compares as follows:

	1909.	1908.
April gross	$ 608,024	$ 546,162
Expenses	374,202	*350,426
April net	$ 233,822	$ 195,737
Other income	11,680	4,998
Total income	$ 245,502	$ 200,735
Charges and taxes	154,155	*134,249
April surplus	$ 91,347	$ 66,486
Four months gross	2,276,066	2,049,991
Expenses	1,438,353	*1,360,240
Four months net	$ 837,713	$ 689,751
Other income	46,236	19,480
Total income	$ 883,949	$ 709,231
Charges and taxes	614,404	*540,132
Four months surplus	$ 269,545	$ 169,099

*Taxes in 1908 are included in operating expenses.

ELECTRICAL SECURITIES CORPORATION.

The Electrical Securities Corporation has issued its report for six months ended April 30, 1909. The profit and loss account which follows shows a net profit of $254,746, which is an increase of $109,826 over the net profit reported for the year ended October 31, 1908:

Bond interest received and accrued	$157,954
Dividends received on stocks	46,596
Total	$204,550
Bond interest, miscellaneous expenses, etc.	122,622
Net profits from income	$ 81,928
Net profit on sales securities	172,819
Total	$254,747
Surplus October 31, 1908	561,211
Total	$815,958
Preferred stock dividend accrued	25,000
Surplus April 30, 1909	$790,958

KEYSTONE TELEPHONE COMPANY.

It is understood that the Keystone Telephone Company has sold $1,000,000 of its $10,000,000 first-mortgage, thirty-year bonds to Fisk & Robinson, of New York, to pay for improvements. Of the $10,000,000 authorized issue, $5,312,000 was outstanding June 30, 1908.

UNITED RAILWAYS OF ST. LOUIS.

There has been listed on the Philadelphia Stock Exchange $2,477,000 additional mortgage four per cent gold bonds of the United Railways Company, of St. Louis, making the total amount listed $30,769,000.

DENVER GAS AND ELECTRIC.

The Denver Gas and Electric Company reports gross earnings for the fiscal years ended April 30 as follows:

	Gross Earnings.	Increase.
1909	$2,256,841	$217,411
1908	2,039,429	245,664
1907	1,793,765	216,205
1906	1,577,560	229,284
1905	1,348,276	231,887
1904	1,116,389	217,926
1903	898,463	209,399
1902	689,064	.....

Some important statistics for the fiscal year ended April 30, 1909, compared with those for the previous year are as follows:

	1909.	1908.
Miles of mains	229.7	216.515
Gas consumers	28,140	25,478
Gas sold (year)	908,031,200	814,111,300
Electric consumers	24,859	21,140
6-candlepower lamps connected	429,940	360,300
Kilowatt-hours sold (year)	29,612,154	25,531,145

PORTO RICO RAILWAYS.

The report of the Porto Rico Railways Company for the month of April and four months ended April 30 compares as follows:

	1909.	1908.
April gross	$31,870	$28,897
Expenses	16,851	16,309
April net	$15,019	$12,498
Four months gross	128,967	117,493
Expenses	67,499	69,951
Four months net	$61,468	$51,542

BROOKLYN RAPID TRANSIT.

The New York Public Service Commission has issued the quarterly reports of the various companies in the Brooklyn Rapid Transit system for the three months ended March 31, 1909. The statements of the principal four divisions of the system show as follows:

Quarter ending March 31, 1909:

	Bkln. Heights.	Bkln., Q'ns Co. & Sub.	Bkln. Union El.	Nassau Electric.
Gross	$1,612,089	$279,916	$1,611,888	$887,307
Oper. exp.	1,106,583	221,578	1,052,294	695,454
Net	$ 505,505	$ 58,337	$ 559,594	$191,852
Other inc.	16,155	13,296	35,684	36,993
Gross inc.	$ 521,660	$ 71,633	$ 595,278	$228,846
Total deduc. incl. tax.	654,650	120,711	533,597	274,060
Surplus.	*$ 132,989	*$ 49,077	$ 61,681	*$ 45,213
Net previous quarters.	90,118	21,177	424,138	154,139
Surplus 9 months.	*$ 42,871	*$ 27,899	$ 485,819	$108,925

Increases or decreases over the corresponding period of 1908:

Gross	$ 26,738	*$119,233	$ 100,260	$199,783
Oper. exp.	12,482	*32,685	*51,244	163,897
Net	$ 14,255	*$ 86,548	$ 151,505	$ 35,885
Other inc.	*5,005	7,240	156	744
Gross inc.	$ 9,249	*$ 79,308	$ 151,661	$ 36,630
Total deduc. incl. tax.	48,095	7,056	53,625	17,172
Surplus.	*$ 38,845	*$ 86,364	$ 98,035	$ 19,457
Net previous quarters	3,900	*107,433	*308,234	72,738
Surplus 9 months.	*$ 34,945	*$193,798	*$ 210,198	$ 92,196

*Designates deficits and losses or decreases.

TOLEDO RAILWAY AND LIGHT.

The report of the Toledo Railway and Light Company for the month of April and four months ended April 30, 1909, compares as follows:

	1909.	1908.
April gross	$215,315	$202,317
Expenses and taxes	122,472	109,215
April net	$ 92,843	$ 93,102
Other income	237	23
Total income	$ 93,080	$ 93,125
Charges	70,914	70,702
April surplus	$ 22,166	$ 22,423
Four months gross	872,496	829,633
Expenses and taxes	494,498	465,495
Four months net	$377,998	$364,148
Other income	587	2,693
Total income	$378,585	$366,841
Charges	283,780	276,655
Four months surplus	$ 94,805	$ 90,186

Following a meeting of Toledo Railway and Light interests at New York on May 25, it was announced that the committee had arranged for refunding the $12,400,000 maturing bonds and notes for a period of two-and-one-half years. Present bonds will be extended for that time with an increase in interest rate from five per cent to six per cent.

INTERNATIONAL RAILWAY (BUFFALO).

The report of the International Railway Company (Buffalo) for quarter ended March 31, 1909, compares as follows:

	1909.	1908.
Total railway operating revenue.	$995,280	$996,815
Total railway operating expense.	641,600	660,262
Net railway operating revenue.	$353,679	$336,553
Taxes accrued	57,393	58,347
Operating income	$296,286	$278,205
Other income	6,824	6,673
Gross income	$303,110	$284,879
Total deduct. from gross income.	227,999	224,083
Net corporate income	$ 75,111	$ 60,796

CROSSTOWN RAILWAY (BUFFALO).

The report of the Crosstown Street Railway Company, of Buffalo, for the quarter ended March 31, 1909, compares as follows:

	1909.	1908.
Total railway operating revenue.	$196,526	$150,362
Total railway operating expense.	141,708	96,792
Net railway operating revenue.	$ 54,817	$ 53,569
Taxes accrued	13,475	11,838
Operating income	$ 41,342	$ 41,731
Total deduct. from gross income.	37,175	37,175
Net corporate income	$ 4,167	$ 4,556

CUMBERLAND TELEPHONE AND TELEGRAPH.

The report of the Cumberland Telephone and Telegraph Company for the month of April and four months ended April 30 compares as follows:

	1909.	1908.
April gross	$ 531,886	$ 511,378
Expenses	299,083	304,532
April net	$ 232,803	$ 206,846
Charges and taxes	42,622	37,582
April surplus	$ 190,181	$ 169,264
Four months gross	2,118,894	2,049,258
Expenses	1,216,671	1,173,199
Four months net	$ 902,223	$ 876,059
Charges and taxes	173,172	150,539
Four months surplus	$ 729,051	$ 725,520

MONTREAL STREET RAILWAY.

The report of the Montreal Street Railway Company for the month of April and seven months ended April 30 compares as follows:

	1909.	1908.
April gross	$ 294,374	$ 280,736
Expenses	173,552	170,141
April net	$ 120,822	$ 110,595
Charges	37,625	37,495
Surplus	$ 83,197	$ 73,100
Seven months gross	2,107,716	2,027,873
Expenses	1,338,935	1,316,007
Seven months net	$ 767,781	$ 711,866
Charges	218,866	224,109
Surplus	$ 548,915	$ 487,757

PORTLAND ELECTRIC COMPANY.

The report of the Portland (Me.) Electric Company for the month of April, and year ended April 30, 1909, compares as follows:

	1909.	1908.
April gross	$ 27,599	$ 22,442
Expenses	10,487	9,942
April net	$ 17,112	$ 12,500
Charges	9,194	8,798
Balance	$ 7,918	$ 3,702
Dividends	3,286	3,286
April surplus	$ 4,632	$ 416
Twelve months gross	324,766	305,584
Expenses	123,197	133,789
Twelve months net	$199,569	$171,795
Charges	108,639	103,721
Balance	$ 90,930	$ 68,074

AMERICAN TELEPHONE AND TELEGRAPH.

In connection with its listing application to the Philadelphia Stock Exchange, the American Telephone and Telegraph Company presents the following balance sheet as of March 31, 1909:

ASSETS.

Stocks of associated companies	$238,837,868	
Bonds and other obligations of associated companies	69,740,652	$308,578,520
Telephones	9,773,043	
Real estate	2,181,728	
Long distance telephone plant	42,918,547	54,873,319
Cash and deposits	33,190,827	
Temporary cash loans	25,766,500	
Short-term notes	5,427,466	64,384,793
Accounts receivable		3,319,957
Treasury stock		22,110,400
Total		$453,266,990

LIABILITIES.

Capital stock	$212,984,000	
Surplus	25,376,844	
1909 undivided profits	1,465,395	$239,826,239
4 per cent collateral trust bonds, 1929	53,000,000	
4 per cent convertible bonds, 1936	106,427,000	
4 per cent American Bell bonds, 1908	17,000	
5 per cent coupon notes, 1907	6,000	
5 per cent coupon notes, 1910	25,000,000	
Interest and taxes accrued, but not due	1,668,555	
Accounts payable, ins. dividend payable April 15	5,351,054	191,469,609
Depreciation reserve		21,971,141
Total		$453,266,990

The strength of the treasury is suggested by the amount of cash, exceeding $33,000,000, while the company has $31,000,000 besides loaned out temporarily and on short-term notes.

GENERAL ELECTRIC'S BIG BUSINESS.

The General Electric Company's officials report that since February up to the present time orders for the year amounting to $52,000,000 have been booked. This is about eighty-five per cent of the record business of 1907 and twenty per cent in excess of last year's business. On this showing is based the prediction that the business for this year will equal that of any year in the history of the company. Several orders have been received from the United States government. In connection with the government work, Lieutenant-Commander H. A. Pierson has been assigned to temporary duty in the works of the company at Schenectady.

BRITISH WESTINGHOUSE COMPANY.

The British Westinghouse Electric and Manufacturing Company reports for the year ended December 31, 1908, net trading profits of $323,500, against $461,500 a year before, and debit after charges of $37,000, against surplus of $56,500.

CINCINNATI GAS AND ELECTRIC COMPANY BONDS.

The Cincinnati Gas Transportation Company, a corporation controlled by the Cincinnati Gas and Electric Company, has sold to A. B. Leach & Company, of New York city, $3,000,000 first mortgage five per cent bonds, dated July 1, 1908, and maturing 1933.

The principal and interest on the bonds are guaranteed by the Cincinnati Gas and Electric Company, a corporation which owns the only gas and electric-light property in Cincinnati, with continuing franchise, and has paid dividends uninterruptedly of not less than four per cent for about sixty-three years.

The bonds are being offered at 97½ to yield about 5.18 per cent.

KANSAS CITY RAILWAY AND LIGHT.

The Kansas City Railway and Light Company reports as follows for the month of April and eleven months ended April 30:

	1909.	1908.
April gross	$ 542,377	$ 492,472
Net	241,593	224,815
Surplus after charges	87,747	73,798
Eleven months gross	5,939,558	5,620,390
Net	2,584,338	2,694,061
Surplus after charges	885,519	1,010,149

NEW YORK CITY—TRACTION EARNINGS.

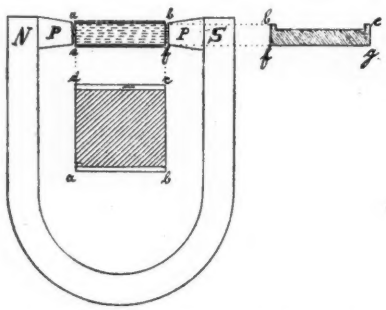
The net income of the subways, elevated, and surface lines in Manhattan for the first three months of this year was $1,603,875, according to figures made public by the New York Public Service Commission. Of this amount, $1,574,203 went to the Interborough—$1,291,440 to the subway and $282,763 to the elevated.

The gross earnings of all the lines totaled $17,094,186, being an increase of $934,159 over last year. The earnings of the elevated were greater than the subway, the figures for the former being $3,521,230 and for the latter $3,321,525. The latter, however, was an increase of over $400,000 over last year, while the elevated earnings only increased $28,000.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

A NEW ELECTRODYNAMIC TELEPHONE.

According to the Maxwell-Faraday conceptions, the power effects of current systems may be explained by ascribing to the induction tubes of their magnetic fields the tendencies to shorten themselves as much as possible, and to increase their cross-section as much as possible. The first-named quality of the induction tubes is utilized in the ordinary Bell telephone for moving the sound diaphragm. The second property is made use of in the telephone here described by Herman Simon, in which the movement of the diaphragm is caused by the pressure exerted by the induction tubes of a coil on the wires of the coil. This is attained in

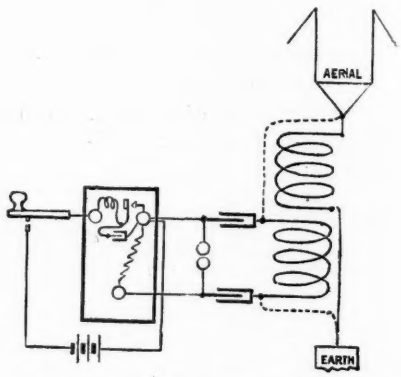


AN ELECTRODYNAMIC TELEPHONE.

the following manner: One or more layers of enameled copper wire of a diameter of 0.1 millimetre, for example, are wound on a small hard-rubber frame *a b c d*, of a cross-section *b c f g*, so that the wires lie close together over the surface *a b c d*, and in their entirety form a diaphragm. In order to unite them completely into such their surface may be covered with shellac and a thin sheet of mica glued to them. The induction flux of a permanent horseshoe magnet or an electromagnet N S is passed through the windings by concentrating it by means of suitable pole-shoes on the cross-section of the coil. If, then, the sound currents from a microphone transformed by an ordinary telephone transformer coil are sent through the coil, the diaphragm *a b c d* will be set into corresponding vibration and reproduce the words spoken into the microphone. In order to collect the sound, the diaphragm is provided with a cover and a sound-hole like an ordinary telephone. In a model constructed on this principle *a b* was 2.8 centimetres, *a c* 0.3 centimetre, and the frame was wound with one layer of about 200 turns of enameled copper wire 0.1 millimetre in diameter. With suitable pole-shoes between the poles of a permanent horseshoe magnet, the telephone reproduced speech with surprising distinctness and purity. The latter quality was to be expected, because those conditions that impair the purity of the sound in the ordinary telephone, as, for instance, the relatively large mass of the diaphragm and consequent prominence of its natural vibrations, are present to a much smaller degree in this new form of telephone.—*Translated and abstracted from Physikalische Zeitschrift (Leipzig), May 1.*

WIRELESS INSTALLATIONS FOR SHORT-DISTANCE SIGNALING.

Through the courtesy of Major O'Meara, of the Royal Engineers, engineer-in-chief to the (British) Post Office, the following account has been prepared of his experiments in wireless transmission over short distances. Messages were exchanged between the post offices at Hunstanton and Skegness, in the adjacent counties of Norfolk and Lincoln, respectively, and separated a distance of sixteen miles by that historic inlet of the North Sea known as The Wash. Temporary aerials eighty feet in height were erected at each station, and the usual earth connection was utilized. The aerial consisted of two 3/18 stranded copper wires spaced about four feet apart, up to their full height of eighty feet, at which point they were extended outward in a sloping direction away from the communicating station. The length of each sloping portion was seventy feet. A motor-car ignition coil of the small high-speed trembler type was used for charging the Leyden jars, with an average current through the primary coil of about two amperes, taken from three small secondary cells. The current in the aerial ranged from one-and-one-half to two amperes, as shown on a Duddell thermo-ammeter. The connections are shown in the accompanying diagram. The secondary of the coil was joined to the inner coatings of two Leyden jars, each .003 microfarad capacity, whose outer coatings were connected through an inductance of four turns of 7/22 copper wire wound on a box approximately twelve inches square. The spark gap of about one-thirty-second of an inch was joined across the jars. The inductance in the jar circuit was exactly similar to another in the aerial, and formed with it the two portions of an adjustable transformer. In another arrangement the aerial and earth connections were joined direct to the jar inductance, as shown by the dotted lines, and the aerial inductance was omitted. An ordinary Morse telegraph



CONNECTIONS AT SENDING STATION.

key carried the primary current without any appreciable sparking. The signals at the receiving station sixteen miles away were most satisfactory, both on a De Forest electrolytic receiver and on a Marconi magnetic detector. The wave length was 800 feet. The results obtained from these experiments are very encouraging, but it must be borne in mind that every small station equipped will need the services of at least two skilled telegraph operators. This requirement is very costly, and will probably, in many cases, ultimately outweigh the cost of a submarine cable fitted with telephones, which anyone can work.—*Abstracted from The Electrical Review (London), May 21.*

CHEAP ELECTRIC PUMPING FOR MINES.

Estimates recently made for two of the largest mines in the Cripple Creek (Colo.) district show that electric pumping figures at about half the cost of pumping by steam. Owing to the fact that pumping gives a more or less uniform twenty-

four-hour load, the power companies make a lower rate for this service than any other. In some cases it is possible, by allowing a large sump to fill during working hours, to do the major portion of the pumping during hours when the power company is underloaded, in which case the rates will be made extremely low, on account of the desirable character of the load. It is now very generally known throughout the district, that for continuous operation, lasting for a considerable period of time, even the most economical steam plants cannot compete with electric power in economy.—*Abstracted from the Engineering and Mining Journal, May 22.*

THE INFLUENCE OF METAL-FILAMENT LAMPS ON THE CHOICE OF THE OPERATING TENSION.

Since the introduction of the electric incandescent lamp there has been no greater progress than that brought about by the metal-filament lamp. Experience has demonstrated that, in a general way, it is difficult to manufacture incandescent lamps of low candlepower for high tensions, and that the difficulties are the greater the lower the specific current consumption of a given type of lamp. The specific current consumption of sixteen and thirty-two candlepower, 220-volt lamps is from six to eight per cent higher than that of 110-volt lamps; by practical men it is estimated to be even ten to fifteen per cent greater, and in the wolfram lamp the excess consumption is said to be ten to twenty-five per cent. Although it is asserted that the light of the sixteen-candlepower lamp is too weak to serve much longer as a standard unit, and that the competition of the incandescent gas light will compel the adoption of lamps with a stronger light, it is doubtful if any other standard unit of lamp will ever attain the same popularity as the sixteen-candlepower lamp. As regards the question of operating tension, it may be summed up as follows: Considerations in favor of the lower tension are: (1) Smaller light units are possible, enabling the attraction of a larger circle of consumers. (2) The light efficiency (lighting power per watt) of incandescent lamp having the same length of life is higher. (3) Only half the number of arc lamps need be connected in series; long-burning arc lamps can be operated singly. (4) In the three-wire system, besides 110 volts, also the double tension is at disposal without transformation. (5) The danger to health and life is smaller. Considerations in favor of the higher tension are: (1) The cost of installing the distribution lines is smaller. (2) Under certain conditions the cost of the house installation is lower. (3) The same dynamos may be employed for lighting and street-railway operation. (4) Nernst lamps for the higher tension are better. The general conclusion to be drawn from this comparison is, that for the consumer the lower tension is of advantage, for the producer and builder of generating stations, the higher tension.—*Translated and Abstracted from the Journal fuer Gasbeleuchtung (Munich), May 1.*

THE X-RAY TREATMENT OF RINGWORM.

The treatment of ringworm has for many years past proved of considerable difficulty, since the fungus exists deeply in the follicle, and out of range of even the most energetic parasiticides. Soon after the discovery of the Roentgen rays it was found that these rays, although they have no bactericidal power, and therefore no direct action on the fungus of ringworm, had the power of causing a temporary loss of hair, and that the new hairs which grew out after the depilation were quite free from the disease. It was also found, however, that the treatment was of very little practical use unless the exposure to the rays was regulated to a nicety; too little exposure always left behind diseased hairs, while too much exposure caused a dermatitis of greater or less severity. M. Sabourand, however, evolved a method long in use by photographers in estimating the actinic value of light. He had a pastille made composed of a substance darkening on exposure to the X-rays. He found the amount of exposure required for complete depilation, and defined the tint attained by the pastilles during that exposure, thereby at once placing the treatment on definite lines. The child's head is exposed to the rays until the pastille has reached the tint of a card surrounding it; the rays are then stopped. The time required varies from fifteen to twenty minutes, and the single exposure is sufficient. In two or three weeks the hair falls out, and in a few weeks more the new hair begins to appear, quite free from the fungus.—*Abstracted from The Lancet (London), May 15.*

ELECTRIC SCRUBBER FOR CLEANING SHIPS.

An electric scrubber for cleaning the bottoms of ships without drydocking has been designed by W. R. MacDonald. The cost of drydocking ships is extremely heavy, and as cleaning is rendered necessary at frequent intervals in spite of the use of expensive antifouling compositions, the new device will prove both convenient and economical. The electric scrubber consists of a flexible hogging-brush which is dragged up and down the steel hull of the ship with ropes, and made to cling firmly to the plates by the use of waterproof electromagnets. The scrubber, or "mat," is composed of a series of battens carrying the brushes and magnets, held together by chains on which cork disks are threaded to give buoyancy and to separate the battens. At each end is a chain bridle, to which the hauling hawser is shackled. The hawser at each end passes through a fair-leader block, which is shackled to a position chain, and so is taken to a steam winch. The mat itself has at each end a leading batten without a magnet, and six ordinary battens, each fitted with two magnets and a set of brushes. The leading battens have each two large brushes set square and in way of the magnets. These brushes clean those strips which would otherwise be untouched by the brushes of the middle battens; they also clean a path for the magnets. On the middle battens the brushes are set diagonally, half being skewed to the right and half to the left; in this way any tendency of the mat to run crooked is counteracted. When the mat has been got over the ship's side and into position, the current is switched on. In that condition the apex of the curve of each magnet touches the ship's side, but the brushes do not touch. There is thus a constant vibration in every direction, normally to the ship's side, owing to the fact that a couple is set up by the pull of the magnet and the resistance to the brushes, and laterally, because the skew at which the brushes are set into the battens causes the whole apparatus to vibrate laterally. The effect is that each batten as it advances flicks the filth out in front of it; and an important feature is that the vibration clears the brushes and prevents them from clogging. The scrubber has been tried on ships of every type, and with complete success. It can be got out in an open roadstead, in any weather, and with any tide; indeed, the tide helps to get it into place. It calls for few men to work it, and it does its work quickly and thoroughly.

The Ship Cleaning Company, Limited, of 23, St. Swithin's Lane, London, E. C., the patentee and manufacturer of the complete gear, can clean a 4,000-ton ship for $100; the time taken would be about eight hours.—*Abstracted from the Electrical Review (London), May 28.*

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Sign and Decorative Lighting with Tungsten Lamps.

It is generally recognized that the best results in sign lighting are secured by the use of small candlepower lamps, as in this way the letters and design in general can be more clearly outlined. As a rule four-candlepower lamps are used, and in some cases two-candlepower lamps have been employed to a considerable extent. The manufacture of low candlepower tungsten lamps for use on the ordinary lighting pressure is commercially impracticable at the present state of the art on account of the extreme fineness of the filament that would be required.

Recently low-voltage tungsten lamps of various sizes from the miniature up have been perfected, and on account of their comparatively thick and short filaments these lamps stand harder usage and have a longer life than the higher-voltage tungsten lamps. By using a special transformer stepping down from 110 to approximately ten volts the use of these low-voltage tungsten lamps is made possible.

The ordinary four-candlepower carbon sign lamp absorbs a total of 19.28 watts per lamp as compared with a total consumption of five watts in the case of the four-candlepower tungsten lamps. The saving is a ratio of substantially four to one, and therefore graphically evidences the commercial possibilities and desirability of this new combination.

The following example worked out in elementary arithmetic on the basis of five hours' burning per day and 100 lamps for the sign shows the marked saving resulting from the substitution of the tungsten for the carbon lamp for sign, decorative and outline installations:

USING CARBON LAMPS.

100 lamps × 19.28 watts × 5 hours = 9.64 kilowatt-hours per day.
365 days × 9.64 = 2,618.6 kilowatt-hours per year.
2,618.6 kilowatt-hours at five cents = $130.93 cost per year

USING TUNGSTEN LAMPS.

100 lamps × 5 watts × 5 hours = 2.5 kilowatt-hours per day.
365 days × 2.5 = 912.5 kilowatt-hours per year.
912-5 kilowatt-hours at five cents = $45.-62 cost per year.

From the above it will be noted that the difference in operating cost is $85.31 in favor of the tungsten lamps. It should be borne in mind, however, that from this apparent saving should be deducted the transformer initial cost and its cost of operation, which amounts to $13.75 total, thus giving an actual saving of $71.56 per year. The increased cost of the tungsten sign lamp is largely counterbalanced by the increased life which will frequently reach 2,000 hours.

In considering the cost of transformer operation it should be remembered that the core loss which in this case is twenty-one watts and the copper loss of eleven

TYPICAL TUNGSTEN SIGN-LIGHTING TRANSFORMER.

watts should be figured for five hours, in that the transformer operates at approximately full load. It should also be remembered that in ordinary sign lighting the proportion in transformer core losses is quite high; in that signs like other current-consuming devices are operated from the regular lighting or power mains, energized twenty-four hours a day and therefore entailing a constant core loss in the various transformers supplying the lamps, a proper percentage of which loss is chargeable against the signs. On the other hand, the tungsten transformer is connected between the control switch and the lamps, so that the core losses only go on while the lamps are burning.

The use of the combination outlined above is advantageous both to the customer and the central-station manager, as it enables the first to use a greater sign capacity for the same money and enables the second to secure more customers.

A decided advantage in using the tungsten lamp transformer for low-voltage lamps instead of placing a group of ten or so in series across the 110-volt circuit is that it permits any number of lamps to be used and avoids the complete extinguishing of a row of lights when any lamp burns out.

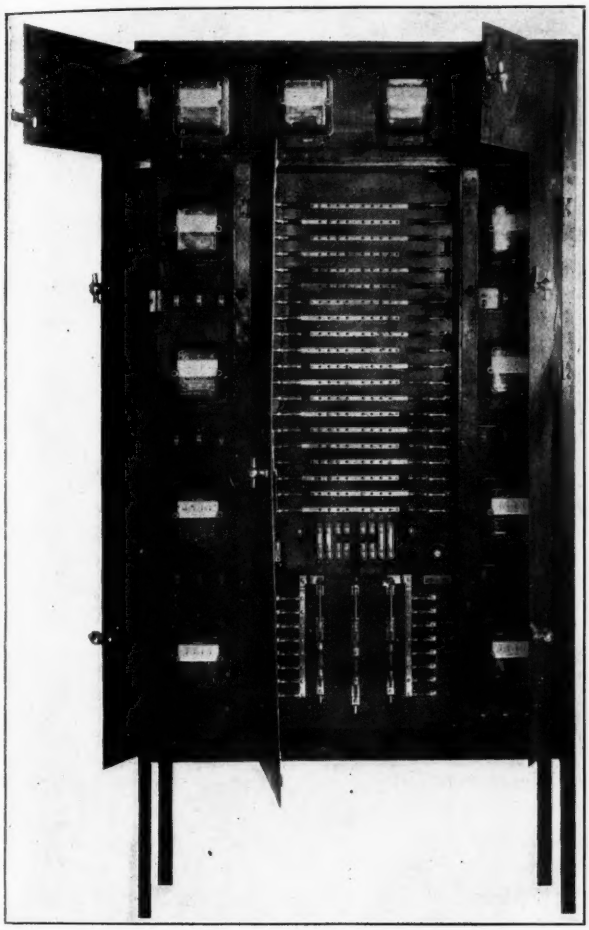
The tungsten sign lamp is an exceptionally economical medium for the illumination of drug stores, libraries, dens and reception halls, as well as for sign and outline work.

The McWilliams Metering Panel Board.

In large office buildings where there are frequent changes in the tenants and in the numbers of rooms leased to each tenant, considerable expense has been incurred heretofore in rearranging the electric wiring in accord with these changes. The McWilliams metering panel board, a patent on which has just been granted, has been devised to suit such conditions. This panel board has been designed to permit the rearranging of office space without disturbing the wiring circuits at the distributing center. By means of it any number of lighting circuits may be connected with any meter, and conversely any meter may be connected with any circuits desired.

The panel board consists of a slate or marble slab, on the front of which the distributing busbars are placed horizontally with their accompaniment of switches and fuses. The meter loops are grouped around the main switch and the entrance of the main conductors. The meter loops are connected through the slab with a set of busbars on the back of it that run vertically and cross at right angles the distributing bars on the front just referred to. At every other point of intersection there is drilled a hole through the slab, which permits of the connection of the meter busbars at the back with the distributing busbars on the front. These connections are made by means of copper screw plugs, which are run through the distributing bar on the front of the board, passed through the hole in the slab, and are screwed into the meter busbar on the back. By means of these connections the circuit from any of the lighting branches can be connected with any of the meter circuits. The plugs that are used for this connection are finished with

a black head. The holes that are not used are plugged up with short dummy screws, having a copper-finished head. Since all the circuits and holes are numbered it is possible to see at a glance just



McWILLIAMS' METERING PANEL BOARD.

what circuits are connected to a particular meter.

These panel boards are made for both two and three wire distributing circuits and with or without switches in the branch circuits. They can be made up to accommodate any number of branches and any number of meters. The accompanying illustration shows one of these panel boards, equipped with twelve meters and twenty branches, all of which are completely interchangeable. The McWilliams metering panel boards are manufactured by the J. Lang Electric Company, 116-128 Lincoln Street, Chicago.

The Westinghouse Electric Favorite Range.

Cooking by electricity is the modern, sanitary, safe, quick and labor-saving method. It means no fire to kindle and keep up, no ashes, no smoke, no dirt, no gas fumes, no menacing probability of explosion. Electricity furnishes heat in the only form that is absolutely sanitary and free from all objectionable features. That it is an ideal heat for cooking purposes is apparent from its very nature.

The Westinghouse Electric Favorite range is put forward as an ideal device for utilizing electric heat in cooking is apparent from the scientific construction of its heating element. The principle of the electric heater has been known and made use of for many years. There has remained, however, a problem for the engineer to work out, namely, the construction of a heating element combining efficiency, simplicity and durability in a manner that the stove might be recommended for daily domestic use. This problem has been solved in a highly satisfactory manner in the construction of the heating element of this new range. It is made of a practically indestructible material that converts the current into heat at the exact point where it is wanted and in the most effective manner. It is so simple in construction that there is no possibility of its getting out of order or requiring repairs.

The range corresponds in appearance with the most modern design of gas range. The cooking surface consists of six distinct heating units, each of which can be used independently of the others. Both the oven and the broiler are located above the stove so that no stooping is required. The oven is heated by five distinct heating units so connected that any one or combination may be used without switching in the others. The broiler is heated by five units similar to the oven. This heating by separate units makes it possible to regulate the heat with great exactness and keep it at the temperature desired. Beneath the broiler is located the reservoir, getting its heat from a double immersion coil. Under the cooking surface is an open plate-warmer and beneath this is a shelf for cooking utensils. Thus it is more complete than any gas range and also more convenient and practical.

The units in the oven and broiler are designed for 320 watts each, and those on the cooking surfaces for 500 watts each. The water heater takes 700 watts. All of the heating units are readily accessible for cleaning. There are no stove lids to bother with, for the heat is in the stove top itself and not underneath, as in all other stoves except the electric. The

WESTINGHOUSE ELECTRIC FAVORITE RANGE.

heat is always uniform so that cooking and baking can be done better and in less time than on another stove. The range needs no chimney connection and so it is not limited as to location.

Detachable Push-Button Switch.

While there are many good switches on the market at present, with mechanisms that are well-nigh perfect, the switch herewith described is claimed to more than meet the requirements.

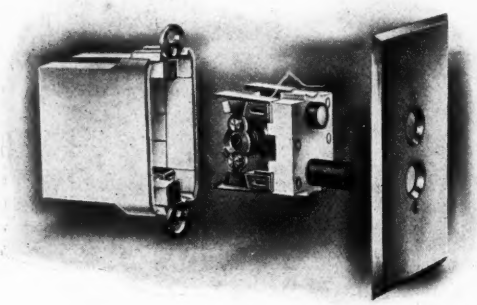
The feature of this switch is that the plug mechanism can be very quickly taken out for inspection, repair or replacement, without in any way disturbing the connections.

The method of installation is very simple. When the wiring work is entirely completed, and the plastering and decoration of the walls are done, the black sheet fiber filler is removed from the box, the plug mechanism is inserted, and the face-

plate is put on. If the plug mechanism is properly inserted, there will be no binding of the buttons in the face-plate holes. The button and plate screw holes should be properly lined up before the plate is screwed on.

The best of material and workmanship are used in the construction of the mechanism, and the lock and unlock are both positive. A dummy plug and a dummy plate without buttonholes can be obtained for use with this type of fitting. These are used to replace the mechanism plug and the buttonhole plate when at any time it is desired to run a circuit through the box.

The detachable push-button switch is manufactured by the Metropolitan Switchboard Company, of New York city, and the plug mechanism is guaranteed for two years from date of purchase.



DETACHABLE PUSH-BUTTON SWITCH.

Severe Test of the Couple-Gear Truck.

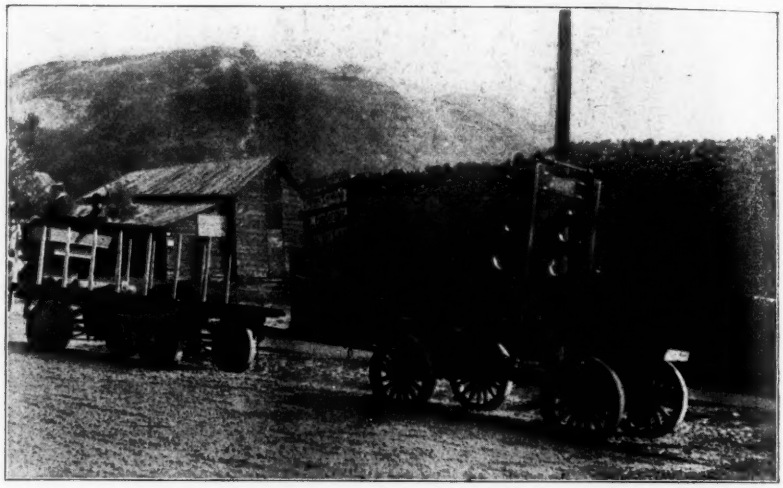
The accompanying illustration shows a five-ton "Couple-Gear" electric truck, unloaded, hauling a thirteen-ton planing machine loaded on a three-ton trailer, a truly remarkable performance, which was accomplished without a hitch. This occurred in March of last year, when the Oliver Machinery Company, of Grand Rapids, Mich., moved their entire equipment of machinery from their old location to a new plant. The work of dragging the many heavy machines out of the old plant on two trailers, hauling them to the new plant, and then dragging the machines into the building, was done by the five-ton electric truck. The largest combination load hauled was five tons on the truck and eleven tons on the trailer, which was handled with apparent ease.

The photograph which we reproduce was taken on a two-and-one-half per cent grade which had been recently covered with six or eight inches of gravel, a fact which makes the performance all the more remarkable.

The "Couple-Gear" truck was manufactured by the Couple-Gear Freight Wheel Company, of Grand Rapids, Mich. Particulars of the trucks manufactured by this company were given in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of February 13 and April 10, this year.

A New Line of Wagner Transformers.

The Wagner Electric Manufacturing Company, of St. Louis, has just placed on the market an entire new line of "central station" or "distributing" transformers. In announcing this new line the company calls attention particularly to the following considerations: Leakage current, ability to stand excess line voltage, proper ratio between iron and copper losses, parallel operation, equipment of taps for varying the ratio, method of insulation and facility of repairs. Recent marked improvements in transformer design and construction give new significance to some of these points heretofore neglected, and they may therefore at this time be discussed to advantage.



HAULING A 13-TON PLANER, LOADED ON A 3-TON TRAILER, WITH A 5-TON COUPLE-GEAR ELECTRIC TRUCK.

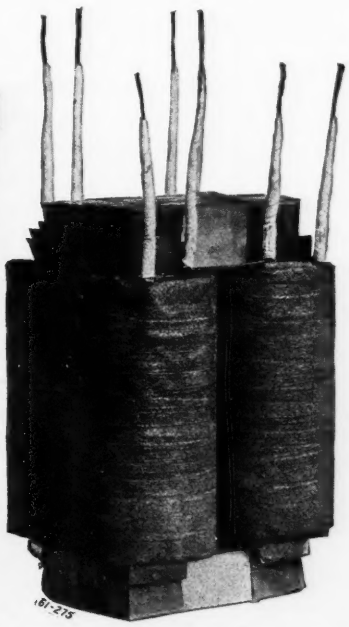
In the early days when there were only two or three companies manufacturing transformers, leakage current was of prime importance. Tables of transformer data in the manufacturers' catalogues contained no such feature as "core loss in watts." There were no commercially available wattmeters and "leakage amperes," as the tables designated that this matter of leakage or magnetizing current was the criterion of good design. The Wagner Company attained distinction in those early days by producing a transformer with low-leakage amperage.

With the introduction of commercial wattmeters, leakage current has apparently receded into the background, iron loss in watts coming to the front; leakage current is no longer tabulated, discussed or referred to in engineers' specifications. Up to recently this caused no substantial danger to the transformer user, as low leakage had become inherent to all designs. Recently, however, and particularly within the last two years, sheet steel has undergone radical improvement. This improved steel, variously termed "alloy steel," "silicon steel," etc., permits high-leakage current while still retaining small iron losses in watts under normal operating pressures. High-grade transformers will have low iron loss in watts as well as low-leakage current. The inferior types will be much lighter in weight, and although possibly having the same core loss in watts may also show a very heavy leakage current.

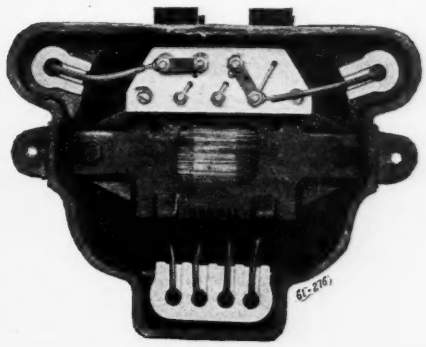
High-leakage current involves two very serious disadvantages, namely, transmission lines and generators are loaded up with current of low power-factor unnecessarily, and transformers with heavy leakage currents will not withstand reasonable excesses of line voltage. High-leakage current indicates high magnetic induction in the steel of the transformer. Transformers operating normally under high magnetic induction will not safely withstand reasonable variations of line pressure. If during intervals of heavy load the line pressure goes up, say, as it sometimes does, ten per cent, two things will happen—the leakage current will increase rapidly and may equal full-load current, with no actual load on the transformer, and not only will the leakage current run away but the iron loss in the

transformer becomes very excessive. Transformers, though normally low in iron loss, if high in leakage current, will rise enormously in iron loss under increased line pressure.

LARGE SIZE OF WAGNER CENTRAL-STATION TRANSFORMER.



WAGNER 10-KILOWATT CORE-TYPE CENTRAL-STATION TRANSFORMER WITHOUT SHELL.



CONNECTING BOARD FOR VARYING THE RATES OF TRANSFORMATION AND INTERCHANGING PRIMARIES.

Under the subject, proper ratio between copper and iron losses, it may be pointed out that the desire for a transformer with high all-day efficiency may lead to abnormal design as to division of losses between iron and copper. For instance, a transformer with 100 watts total loss might be designed with twenty watts in iron loss and eighty watts in copper loss at full load. This same transformer might be designed with fifty watts iron and fifty watts copper loss. While the first would be preferable for strictly lighting service, it would be less suitable for motor service, as the copper loss would become excessive under slight overload, while the second would not. Further, the transformer sacrificed in copper loss to save in iron losses simply throws the higher losses into the peak load. Central-station transformer stock must be largely interchangeable for either lighting or motor service. It is very alluring to see a five-kilowatt transformer advertised as having an abnormally low iron loss in watts, but the transformer with an abnormally low iron loss should not lure the purchaser into an unwise investment. The immediate question should be, "What is the copper loss?" The Wagner Company's policy is to strive toward a balance between all elements. It is prepared, however, in special instances where circumstances warrant, to furnish transformers of any desired efficiency in iron or copper losses.

REPAIR UNIT FOR CORE-TYPE WAGNER CENTRAL-STATION TRANSFORMER.

This discussion leads directly to the question of parallel operation. It is claimed that there are two classes of transformers sold for parallel operation—those intended to take their share of the load and those not intended to take their share of the load, and that when one of two transformers operating in parallel burns out, it is almost sure that the better transformer has broken down. The Wagner Company points out how copper losses, regulation and impedance will indicate whether a transformer will stand up under its share of the load or will shirk and cause burnouts in the other in bank with it.

Wagner central-station transformers are equipped with connecting boards within the case, as shown in an accompanying illustration, so as to obtain any of the following ratios of transformation:

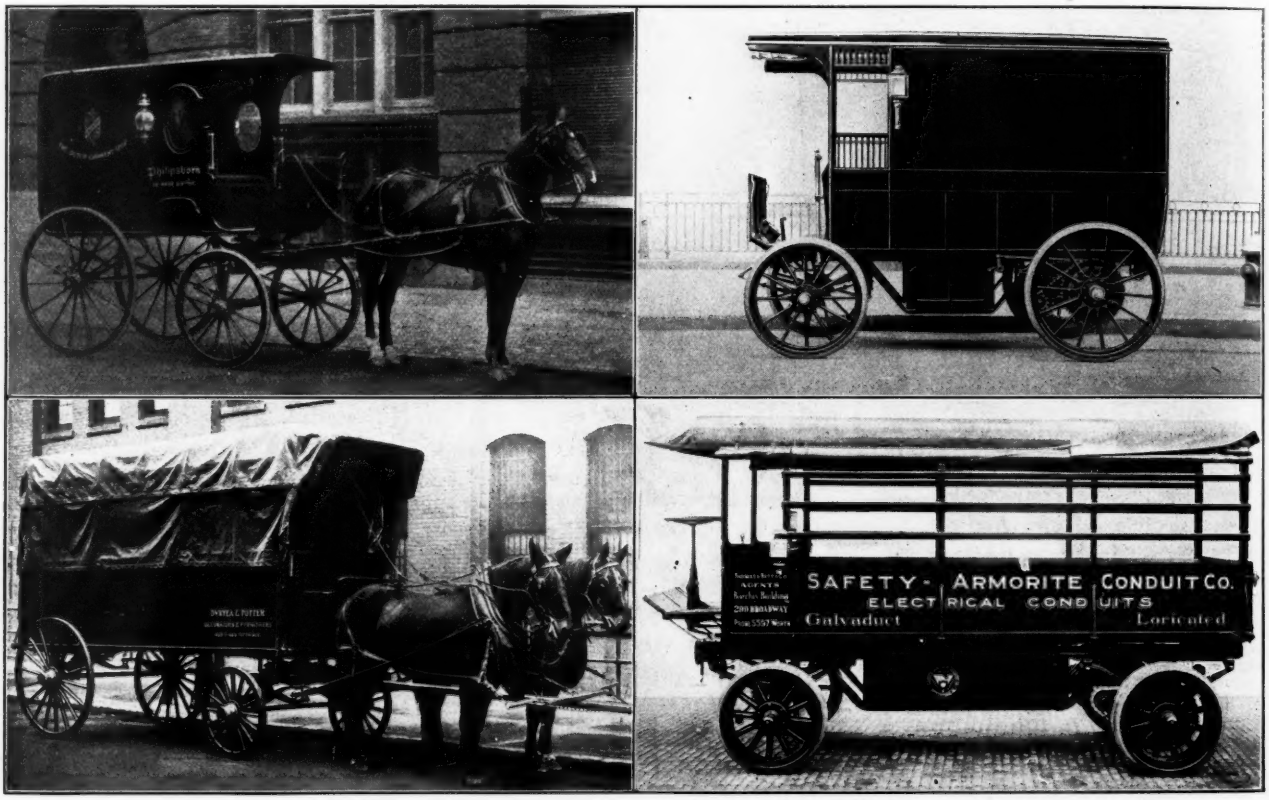
1,100/2,200-110/220
1,080/2,160-110/220
1,100/2,200-115/230

This enables the operation of the transformer at different ratios according to the demands upon its particular circuit.

The method of insulation employed in transformers is largely a manufacturing question, and manufacturers differ somewhat widely on this feature, not so much as to the quality and character of materials employed, but as to the method of application. A more compact winding can be developed with somewhat smaller iron and copper losses with single-covered wire in the primaries than with double-covered wire. Manufacturers agree that a single cotton covering is in itself insufficient insulation. The division of opinion comes on the question of whether to wind the coils first with cotton-covered wire, injecting additional insulation from the outside after the coils are completed or to employ sufficient insulation to begin with and omit the injecting process afterward. With reference to this discussion of the advisability of the impregnation or injection process, the Wagner Company, although having at its factory an impregnation system that has been in service to a limited extent for

seven or eight years, believes it to be a safer procedure to equip transformers with all necessary insulation without impregnation than to depend partly upon the uncertainty of the impregnating process and partly upon the covering of the wire.

In these new Wagner transformers facility of repairs has been given especial consideration. In the sizes employing the core type a repair unit as shown is furnished, consisting of a half set of primary and secondary windings, together with the section of the iron core upon which these coils are wound. In the event of a complete burnout from overload, two of these repair units can be easily installed by the user. In the sizes built in the shell type one-half set of primary and secondary windings can be supplied as repair parts, but in these sizes no iron section is included, as the coils are wound independent of the iron.



PIERCY'S ONE-HORSE AND TWO-HORSE TEAMS, AND OPPOSITE THEM THE RESPECTIVE STUDEBAKER ELECTRIC AUTOMOBILES THAT REPLACE THEM.

Automobiles Supplant Horse Vehicles.

The passing of the horse was never more significantly indicated than by the contract just executed between the H. C. and A. I. Piercy Company and the Studebaker Bros. Company of New York, in which the former purchases from the latter an equipment of electric automobiles whereby the motive power of its present immense delivery contract business will be changed over from horses to machines.

Before this step was finally taken by the Piercy Company, almost a year was occupied in the refinement of detail under which the new system will be carried into practice, and the entire service now rendered by this company was first thoroughly analyzed by the engineering department of the Studebaker company. As assurance to the Piercy company and its customers, its mechanical department will have the guidance and direction of the Studebaker Company's engineers until the Piercy organization is thoroughly qualified to handle the installation independently.

The present headquarters of this company are located on West Fifteenth Street, and comprise a six-story and basement building, containing about 90,000 square feet of floor space. The structure is a comparatively new one, and is practically fireproof. Two elevators are in service capable of handling the heaviest machines; and the stable fittings with which this building is at present equipped were installed in such a manner as to permit their easy removal whenever the building should be devoted to automobile-garage purposes.

It has at present an equipment capable of caring for 400 horses and 250 delivery wagons and trucks, and with the use of machines there will be ample accommodation for about 500. In Brooklyn there is a substation on Cleremont Avenue which will accommodate fifty machines; and additional substations will probably be added in the Bronx, on Long Island, and in Jersey.

It is generally conceded that the conversion of the equipment of this well-known and reputable organization will add considerable stimulus to the use of commercial automobiles in New York city, and will lead many firms into the use of machines which would otherwise hesitate for some time to invest in them.

Western Union Must Pay.

Judge Pollock in the Federal court, Topeka, Kan., has upheld the law creating the State Tax Board and affirming a tax of $3,154,000 assessed by the board against the Western Union Telegraph Company.

The company brought suit, declaring the assessment excessive and the board's act unconstitutional.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, MAY 29.—A short while ago the Comptroller General of Patents revoked the Bremer arc lamp patent on the ground that it was not being worked to an adequate extent in the United Kingdom. This decision was come to under the powers of Section 27 of the new Patents Act, and was upon the petition of a Mr. Braulik, an importer of German arc lamps, against whom, by the way, the Westinghouse Company, as owner of the British rights of the Bremer lamp, had instituted proceedings for infringement of patent. General satisfaction, however, is felt now that the Appeal Court has reversed the decision of the Comptroller General and restored the patent. The Appeal Court judge stated that he was satisfied the British Westinghouse Company had done, and was doing, its best to create an arc lamp industry in this country, and he apprehended that when the action for infringement of copyright was settled, the company would be able to carry on a successful business. In this connection it may be mentioned that the Westinghouse Company has instituted proceedings against some half a dozen other makers of flaming arc lamps in this country for infringement of the Bremer patents, and if they are all proceeded with there is an interesting time ahead in the courts. With at least one of them negotiations have proceeded with regard to granting a license, and this course of action may dispose of a few of the actions. At the same time the Westinghouse Company is face to face with a curious position with regard to the validity of its own patents in relation to a patent held by one Hogner, chief engineer to the Korting & Mathiesen Company of Germany. Owing to the doubt surrounding this question the Westinghouse Company and the Korting & Mathiesen Company have entered into agreements, but it is probable that the decision of the Appeal Court referred to above may force the testing of the validity of both of these patents.

At the annual dinner of the National Telephone Company last week end it was hinted that that would be the last of those annual functions, an echo of the statement recently made by the Postmaster General that it was probable the company would be taken over by agreement before the actual expiration of its license. If this course of action is taken, it will be in order to preserve continuity in construction work, which the company naturally is inclined to restrict with a view to insuring a return upon all capital expended during the remainder of its term. In other words, should the company run the full term, viz., until December 31, 1911, it would be necessary to abandon the policy of installing plant in advance of immediate wants because under the purchase agreement the undertaking is to be purchased without consideration for good-will, and merely upon the value of the plant. The Postmaster General foresees that this policy might result in considerable delay in the expansion of the business when he comes to take it over; hence his desire to acquire the company's business at as early a date as possible.

C. H. Merz, of London, who was responsible for the conversion to electric traction of the first steam railway in Great Britain, has been invited to prepare a report upon the electrification of the Central Argentine Railway.

A bill has been passed authorizing an extension of the Central London Railway known as the "tuppeny tube" from the Bank station to Liverpool Street, where it will join up, by means of a subway, with the main lines of the Great Eastern Railway. This will be an important improvement in means of locomotion in London; so important, in fact, that it was opposed by another company inasmuch as it will create a certain amount of competition on a route which is at present very badly served.

The House of Commons has refused to release the National Electric Construction Company from its obligation to put down a surface contact system in Folkestone. The company claimed that no surface contact system was a commercial success, but full information was placed before the committee by the opponents with regard to the working of the Lorain system at Wolverhampton and apparently the committee was satisfied to the contrary.

An action has been heard in the law courts this week between C. A. Gould, of the Gould Storage Battery Company of America, and the London Electrobus Company, in which the former claimed $16,100 for batteries supplied to the company for its buses in London. In giving judgment for the amount claimed, the judge made some strong remarks concerning the action of the company in the matter of arranging for the tests under the contract to be carried out. He charged one of the directors with having wilfully prevented the tests being carried out, and also with having wilfully misinformed Mr. Gould concerning the flotation of an English Gould Storage Battery Company.

In Bradford the tramway gauge is four feet and in the neighboring town of Leeds the gauge is 4 feet 8½ inches. At one time through running between the two systems appeared to be out of the question, but the Bradford tramway manager succeeded in inventing an extensible gauge tramcar truck which adjusts itself automatically as it proceeds from one gauge to the other. So successful has a trial of through running by means of this truck proved, that the two authorities have decided to inaugurate a ten minutes' through service.

At the annual meeting of the British Westinghouse Company last week when a considerable loss on the year's working was announced the vice-chairman of the company expressed the opinion that electrical engineering in Great Britain would never be on a sound footing until purchasers of machinery realized the enormous advantages of standardization. He stated this had been the main factor in American and German success.

It is expected that the Institution of Electrical Engineers will be in its new home on the Victoria Embankment by the end of next month. A considerable number of technical books have recently been acquired and the institution can boast of being in possession of the finest technical library in the United Kingdom.

G.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, JUNE 5.—Provincial ownership of long-distance telephone lines was unanimously favored by the Southern Counties Independent Telephone Association, at its first annual convention held in the city of St. Thomas, Ont., last week.

The special telephone committee of the City Council of Toronto has recommended that the city renew its application to the Ontario government for a referendum on the question of taking over, by the government, of the telephone service throughout the province, and that the cities and towns of Ontario be requested to co-operate in having a vote of the people taken on January 1, 1910.

The first units of the great hydraulic power plant at Fort Francis, Ont., that is nearing completion there, will likely be turned on in August next. As a result many large industries are already being established in the neighborhood.

Sir Edward Clouston, president of the Bank of Montreal, has been elected a director of the Kaministiquia Power Company, which has harnessed the Kakabeka Falls, near Fort William, Ont. The company has made excellent progress, in the short time it has been in operation, and it is understood that the company's bonds amounting to $1,500,000, and stock, $2,000,000, will shortly be listed on the Montreal and London, England, stock exchanges.

Private dispatches from Mexico City state that the real story of the break in the Necaxa dam of the Mexican Power Company in which so many Canadians are financially interested, has been suppressed. There is every reason to believe that the dam has been destroyed and the damage, in consequence, will be enormous.

A. V. W.

WESTERN CANADA.

(Special Correspondence.)

WINNIPEG, JUNE 7.—Sealed tenders will be received by J. H. Truesdale, city clerk, until five o'clock, June 22, for the supply of the following electrical machinery: (A) 500-kilowatt, 2,200-volt, 60-cycle, 150 revolutions per minute, two-phase generator, exciter and switchboard, installed complete. (B) 750-horsepower, 150 revolutions per minute, vertical cross-compound Corliss engine, wtih the necessary condensing apparatus, installed complete.

A syndicate of French capitalists, represented by Short, Cross & Biggar, attorneys, Edmonton, Alta., will in all probability be granted a franchise for the construction of 180 miles of electric car lines radiating from Edmonton, Ala. One of the franchises was held by the city and the Council is strongly in favor of the proposition.

The Manitoba government has purchased the telephone system owned and operated by the municipality of Turtle Mountain. The municipality found that it was unable to operate the system as cheaply as the government, therefore decided to sell out.

The annual meeting of the Canadian Street Railway Association was held in Winnipeg May 31, June 1 and 2. The proceedings, as usual, were held in camera, but it is understood several interesting decisions were arrived at pertaining to street-railway matters in the Dominion. The election of officers resulted as follows: President, D. McDonald, manager of the Montreal Street

Railway Company; vice-president, T. Anderson, manager of the Sandwich, Windsor & Amhertsburg Street Railway Company; secretary, Acton Burrow, managing director Railway, Marine and Shipping World, Toronto, Ont.; executive, P. Dubee, secretary-treasurer of the Montreal Street Railway; E. A. Evans, general manager Quebec Railway, Light and Power Company; J. E. Hutchinson, Ottawa Street Railway; R. J. Fleming, manager Toronto Street Railway; C. B. King, manager of the London Street Railway; assistant secretary, a new office created at the convention, Audrey Acton Burrows, of the Railway, Marine and Shipping World, Toronto, Ont. The delegates to the convention, of which there were about thirty, were entertained at luncheon by Wilford Phillips, general manager of the Winnipeg Electric Railway Company, and were also taken for trips over several of the suburban lines. The selection of the date and place of next year's meeting was left in the hands of the executive.

At a meeting of the Ellisboro Rural Telephone Company, held at Napinka, Man., it was decided to call for fifty per cent of the subscribed capital in order to receive the assistance of the Manitoba government for the construction of a rural telephone system, Address G. P. Campbell, Napinka, Man.

The Alberta government has decided to install automatic telephone systems in East Calgary and Lethbridge. A contract for this purpose has already been let to the Automatic Electric Company, Chicago, Ill. It is the intention of the government to install automatic systems in all exchanges throughout Alberta as soon as circumstances permit. Address W. H. Cushing, minister of public works, Edmonton, Alta.

The Western Canada Power Company, with headquarters at Vancouver, B. C., is the name of the company which will immediately take over the works and assets of the Stav Lake Power Company. This concern has a capital of $5,000,000 and is backed by a number of capitalists of Montreal, Que. It is the intention of the company to immediately develop an increased "head" and supply a number of industries in the vicinity of Vancouver, B. C.

After being in session for two weeks the arbitration board appointed at the request of the employes of the Winnipeg Electric Railway Company, of Winnipeg, Man., has arrived at a decision. The men asked for a nine-hour day with ten hours' pay, but the company refused to consider the question. It was pointed out by the men that living has increased in Winnipeg during the past year and this was the chief ground upon which the advance in salary was asked. W. J. Christie was appointed to act for the company, J. G. O'Donoghue by the men, and the Dominion government selected Rev. C. W. Gordon (Ralph Connor) as chairman. The finding was unanimous and was accepted by both the company and the men. In short, it provides for an increase of one cent per hour on a sliding scale, ranging from 21 cents for new men to 27 cents for men who have been in the employe of the company for four years and more. Several minor concessions were granted the men, namely selection of runs by priority, which was virtually in effect before the arbitration.

The following are the details of the machinery, for which the city of Winnipeg will receive tenders until 11 a. m., August 2, all prices to be f. o. b. Winnipeg, Man.: (a) Five 5,200-horsepower turbines, two 450-horsepower turbines; (b) five 3,000-kilowatt generators, two 250-kilowatt generators; (c) six step-up transformers; (d) light, heat and power systems; (e) protective apparatus; (f) electric traveling cranes; (g) auxiliary apparatus. Plans and specifications may be seen at the offices of Smith, Kerry & Chace, civil engineers, Toronto, Ont.; William Kennedy, C. E., Y. M. C. A. Building, Montreal, and at the municipal power offices, Winnipeg, Man. Tenders for the supply of the above machinery should be addressed to Magnus Peterson, secretary civic board of control, Winnipeg, Man. R. F. R.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

OSWEGO LIGHT AND POWER—The New York Public Service Commission, Second District, has authorized the Oswego County Light and Power Company to increase its capital stock from $100,000 to $1,000,000 and to issue $4,000,000 bonds. This company has a comprehensive scheme for the development of the waterpower on the Salmon River.

TO REORGANIZE WHITNEY COMPANY—The Whitney Company is to be reorganized shortly, it is stated, and work at the great plant will be resumed without delay with ample capital. It is not known as yet what interests will come into possession of the property. This feature of the case will be determined by Judge Pritchard's decision, which, it is expected, will be rendered some time next month.

STOCKHOLDERS OF NIAGARA FALLS POWER COMPANY AUTHORIZE MORTGAGE—Stockholders of the Niagara Falls Power Company have authorized the placing of a mortgage, or deed of trust, upon the company's Canadian and American property, rights, privileges and franchises to secure a six per cent bond issue of $25,000,000, payable January 1, 1932. Certain debentures mature between April, 1910, and November, 1914, and the directors in connection with their refunding considered this an opportune time to deal with the question of financing additional construction on the Canadian side.

COLUMBIA POWER, LIGHT AND RAILWAYS COMPANY—This holding company has been incorporated in Delaware to take over the stock and bonds of the following companies operating in Pennsylvania: Berwick Electric Light Company, Berwick; West Berwick Electric Light Company, West Berwick; Columbia and Montour Electric Railway Company, Danville and Bloomsburg Street Railway Company, Irondale Light, Heat and Power Company, Irondale; United Gas and Electric Company, Bloomsburg; Standard Gas Company, Danville; Standard Electric Light Company, Danville; Nescopeck Electric Light, Heat and Power Company, Nescopeck. The Columbia Power, Light and Railways Company, the new holding company, approaches in capitalization $1,250,000 and owns the electric lighting and gas properties of Danville, Bloomsburg and Berwick and the electric railways connecting these towns. Prominent men of Harrisburg, Pa., are largely interested in it.

THE SOUTHERN POWER COMPANY—Following the announcement that the Southern Power Company, of Charlotte, has taken over the electric lighting interests at Chester, S. C., and will have charge of the lighting of that town, and the furnishing of power for a number of industries, comes the later announcement that the Chester Power Company has been chartered under the laws of New Jersey for the purposes mentioned, the Southern Power Company having launched the new company as a subsidiary concern, with $50,000 capital to begin with. As the Southern Power Company has interests equally as important in a score of other towns, the organization of this company is considered to be of special significance, though none of the officials have given out a statement concerning the newly organized concern. The many other large contracts and interests of the Southern Power Company in cities and towns all over the Piedmont section of the Carolinas have been so far operated directly by the Southern Power Company with the single exception of the Chester interests. It may be stated that Dr. Gil Wylie, president of the Southern Power Company, is also president of the new subsidiary company, the Chester Power Company, of Chester, S. C.

THE INTERSTATE LIGHT AND POWER COMPANY—This company has recently been incorporated with a capital of $750,000 and headquarters at Galena, Ill., for the purpose of constructing a large electric power plant with a capacity of about 5,000 kilowatts, and of building about twenty-six miles of primary power lines and sixteen miles of secondary lines, these to extend throughout Jo Daviess County, Ill., and La Fayette, Grant and Iowa counties, Wis. The main transmission line will extend from Galena, Ill., to Platteville, Wis., furnishing twenty-four-hour-lighting service to these two cities and all of the intervening towns. This new company has acquired all of the properties, franchises and power contracts of the Tri-State Light and Power Company, of Galena, Ill., and the Platteville Electric Light and Power Company, of Platteville, Wis. The individuals interested in this project are men well known in this line of business. The designing engineers are H. M. Byllesby & Co., American Trust Building, Chicago, Ill. The directors of the power company are as follows: A. O. Fox, Madison, Wis.; Fred Krog, Platteville, Wis.; Geo. B. Caldwell, Chicago, Ill.; M. S. Sickle, Platteville, Wis.; O. E. Osthoff, Chicago, Ill.; A. T. Rogers, Madison, Wis.; M. F. Fox, Madison, Wis.

LIGHTING AND POWER.

(Special Correspondence.)

DELIGHT, ARK.—John Hill is to construct an electric-light plant here.

PALACIOS, TEX.—A. C. Randolph has been granted a fifty-year franchise for an electric-light plant.

CHICO, CAL.—The Sierra Electric Power Company has been granted an electric franchise in that city.

TULIA, TEX.—The Tulia Light and Ice Company has been incorporated with a capital stock of $10,000.

LOS ANGELES, CAL.—The West Side Electric Company has been incorporated with a capital stock of $75,000.

PALO ALTO, CAL.—This place has voted bonds for the erection of an electric lighting system and for an electric fire-alarm system.

MAMMOTH SPRINGS, ARK.—The Mammoth Springs Electric Light and Power Company has been incorporated with a capital stock of $10,000.

SAN FRANCISCO, CAL.—The Economic Gas Company of Santa Cruz, Cal., has filed articles here. The company is capitalized at $1,500,000, and is authorized to manufacture and sell electricity as well as gas for lighting purposes.

KALISPELL, MONT.—The Kalispell Water and Electric Company has sold its entire plant to the Northern Idaho-Montana Power Company, which will expend some $200,000 on improve-

ments here and $100,000 on the improvement of the plant at Big Fork. C.

CALVERT, TEX.—The Calvert Water, Ice and Electric Light Company is spending $40,000 in improving its plant.

GASTONIA, N. C.—The Loray mill is now being operated by electricity supplied by the Southern Power Company.

LOS ANGELES, CAL.—The Surf Light and Power Company has been incorporated with a capital stock of $6,000.

MAHNOMEN, MINN.—The Village Council has purchased an electric-light plant from Fairbanks-Morse for $4,360. C.

JAMESTOWN, N. D.—The Western Electric Company is to add an extensive heating equipment to its plant, involving an outlay of from $20,000 to $22,000. C.

EL PASO, TEX.—The Alpine Power Company has been incorporated here, with a capital stock of $35,000, by R. B. Slight, H. W. Townsend and I. H. Derrick.

EVERETT, WASH.—J. A. Soderburg has arranged with the owners of water rights at Sunset Falls to construct an electric plant there, which will generate at least 7,000 horsepower.

NORTH YAKIMA, WASH.—A. N. Mougin has announced that within a year he will build a power plant on the Yakima River, which will furnish electricity to the amount of 10,000 horsepower.

ANOKA, MINN.—The joint council and citizens light and waterworks committee recommends that $40,000 be offered the owners of the electric-light and water plant for its purchase by the city. C.

SAN ANTONIO, TEX.—The St. Anthony Hotel Company will install a separate electric power and lighting plant. Plans have been adopted for an addition to be built to the present hotel building, at a cost of $500,000.

FRANKFORT, IND.—The Indiana National and Illuminating Company, of this city, has been succeeded by the Indiana Lighting Company, which will erect and equip a large lighting plant here. The company is capitalized at $4,500,000. S.

DOTHAN, ALA.—The city has engaged J. B. McCrary & Company, Empire Building, Atlanta, Ga., to design and supervise the construction of electric-light and waterworks systems, for which a $20,000 bond issue was recently reported voted. H. W. Lisenby, clerk.

WORCESTER, MASS.—A petition has been filed with the city clerk by the Connecticut River Power Transmission Company announcing its desire to bring its power to the city. The announcement has met with a very favorable response from most of the manufacturers.

ATHOL, MASS.—The New Athol Gas and Electric Company is completing plans for a new power station in Wendell. A large concrete dam will be built about 150 feet from the present power house at Wendell, that will have about three times the storage capacity of the present dam.

GONZALES, TEX.—The Gonzales Electric Light and Power Company has contracted with the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., for a 350-kilowatt generator, to develop about 460 horsepower. It is to furnish power for a cotton mill and other local industries.

NORTH YAKIMA, WASH.—The Eagle Valley Development Company has been incorporated here with a capital stock of $40,000 by Owen Jones, Harry V. Bonniwoll and Reuben L. Garrett. The company will maintain offices in this city and supply electricity for power and lighting purposes.

CHICAGO, ILL.—The Pullman Company has let contracts for improvements at its plant at Pullman, Ill., which ultimately will cost about $3,000,000. Besides new shops there will be an 8,000-horsepower electric power house, 200 by 150 feet, which is to cost $100,000, and which will furnish power for the passenger shops.

NUEVO LAREDO, STATE OF TAMAULIPAS, MEXICO—The contract has been let by the Nuevo Laredo Light and Power Company for the erection of a large electric power and light plant here. The plant will furnish the town with light and power, and it is said that the company is planning to install an electric street railway. D.

GUADALAJARA, MEXICO—Work is to be started very soon on the construction of the electric transmission line to convey power from this place to the mining districts of Hostotipaquillo and Etzatlan, in the state of Jalisco. A shipment of 100 iron towers for the line has just been received. The total number of such towers to be used will be 1,000. The contract has been let for the installation of a new hydroelectric plant at a point on the Santiago River near this place, which will furnish the power when it is completed. In the meanwhile power for the mining districts will be obtained from the Las Juntas plant of the Compania de Tranvias, Luz y Fuerza, in this city. It is expected to have the line in operation by the coming fall. D.

RED BLUFF, CAL.—E. W. Stores and W. D. Russel have each filed notice of appropriation of water for electric power generating purposes. Mr. Stores, who has filed on 20,000 inches in Mill Creek, to be measured under a four-inch pressure, will divert the water about fourteen miles above the junction of Mill Creek with Little Mill Creek.

TACOMA, WASH.—The St. Helens (Ore.) Mill and Power Company has been awarded water rights on Spirit Lake and the middle branch of the Toutle River, said to be valued at hundreds of thousands of dollars. The company plans spending about $1,000,000 in erecting a power plant and other industries in the St. Helens district.

SUMPTER, ORE.—The Eastern Oregon Light and Power Company has been incorporated here, with a capital stock of $1,500,000, by Ray Nye, F. A. Harmon and John Rand. The Fremont Power Company, the Baker Light and Power Company and the Elk Light and Power Company will be merged into the new organization, with Mr. Nye at the head.

ODESSA, WASH.—M. C. Osborne, representing the Washington Water Power Company, of Seattle, Wash., states that the company has decided to accept the project of supplying this city with electric power if a satisfactory franchise can be secured. If the details can be satisfactorily arranged the company will begin the service not later than July 1.

BATAVIA, N. Y.—The Genesee County Electric Light, Power and Gas Company plant at Batavia, which furnishes electricity generated at Niagara Falls, will be sold June 17, and the receipts from the sale and other assets will be distributed among creditors. The debts of the company have been set at $96,318.73. The assets of the corporation are reported to be $120,616.73.

HOUSTON, TEX.—Work on improvements which will cost $150,000 at the power plant of the Houston Electric Company has already begun. The company will have installed before January 1, 1910, two fifty-horsepower boilers and two large steel stacks, with one 1,500-horsepower engine and an 800-kilowatt generator. New boiler houses will be constructed for the new boilers.

MODESTO, CAL.—Attorney W. H. Hatton and Superintendent Archie Scott, of the La Grange Light and Power Company, have arranged for the purchase of a tract of land near this city, where substations are to be built. By consenting to run a power line through Empire, the company has been granted a right-of-way along the Modesto Interurban Railway line, between Hughson and this city.

CHESTER, PA.—One of the largest and most important deals ever consummated in Delaware County has been closed by the International Gas and Electric Company, a western corporation, assuming control of the Citizens' Electric Light and Power Company, of Clifton Heights, which had been controlled by the Interstate Railways Company and the Philadelphia Suburban Electric Light Company.

PLACERVILLE, CAL.—Jacob Snow has filed here a notice of location and appropriation of 15,000 inches of water flowing in the South Fork of the American River, the water to be taken out not far below the lower plant of the American River Electric Company. At this point Mr. Snow will divert the water and conduct it a distance of two miles to a point where a location has been secured for an electric power plant.

MADISON, S. D.—The City Council has let the contract for installing two engines, eighty and 225 horsepower, respectively, with corresponding gas producers, at the electric-light plant, to the Minneapolis Steel and Machinery Company, of Minneapolis, Minn. The contract for the installation of two dynamos, fifty and 150 kilowatts, respectively, with switchboards, was awarded to the Fort Wayne Electric Company, Fort Wayne, Ind. C.

ANNISTON, ALA.—The Alabama Power Development Company, financed by the Electric Bond and Share Company, of New York, has had a representative in this town seeking franchises for the installation of electric service shortly. Power is being developed at Jackson Shoals, and it is proposed to connect this town and Talladega with transmission lines. The local lighting and street-railway companies are controlled by the above-named interests. L.

DANIELSON, CONN.—The legislative committee on incorporations has made a favorable report on the resolution chartering the Cochrane Power Company, of this place. The special purpose for which the company is to be incorporated is to construct a pole line for the transmission of electricity to the mills of the Danielsonville Cotton Company from the plant which the latter company is building on the Quinebaug River, a distance of about five miles.

MEXICO CITY, MEXICO—The hydroelectric plant of the Mexican Light and Power Company at Necaxa, which was recently put out of commission by a cave-in in one of the water-storage dams, has again been placed in operation and is furnishing the usual power in this city. As the company wished the work which it is engaged in at present at Necaxa to be completed as soon as possible, they have taken over the entire con-

struction work from the contractors. The tunnel, which will divert the water of a river about six miles east of Necaxa into the Tenango reservoir, had been completed to within 100 metres of the end. The water in the Tenango reservoir will be led into another big reservoir through a 1,300-metre tunnel. The big main reservoir, which has a capacity of 45,000,000 cubic metres of water, is practically finished. D.

SALISBURY, N. C.—The resumption of work on the $10,000,000 electric development at Whitney by the Whitney Reduction Company grows more probable each day. Recently the receiver, Col. J. S. Henderson, I. H. Hale, of New York, and others interested, made a close inspection of the plant, and found that there had been no damage caused by the suspension of operations. This plant, if completed, will be among the largest in the South at this time. L.

COLORADO SPRINGS, COLO.—The San Juan Water and Power Company has filed a certificate of incorporation. The company is capitalized at $1,000,000 and the stock is divided into 10,000 shares, at a par value of $100 each. The incorporators are all of Denver. The principal offices of the company are to be located at Silverton, and announcement is made that a part of the business of the company will be carried on in El Paso, La Plata, San Juan and Denver counties.

COLORADO SPRINGS, COLO.—The Central Colorado Power Company, of this city, has just put its new turbine-generating plant into service. It is located at Shoshone, near Glenwood Springs. The plant is capable of generating 18,000 horsepower. The size of the tunnel through which the water runs may be judged from the fact that it is two-and-one-half miles long, sixteen feet wide and eleven feet high. Four hundred carloads of cement were used in its construction.

ATHOL, MASS.—The Athol gas and electric-light plant has been sold to W. G. Webber of Marlboro. A new company has been formed, with the following officers: President, W. G. Webber; vice-president, W. D. Smith; directors, W. G. Webber, W. D. Smith, E. C. Mason, P. B. Webber, G. R. French. The new company will retain the present office in Athol. Mr. Webber has recently come into possession of the Orange Electric Lighting Company, and is also interested in the Marlboro plant.

REDDING, CAL.—The Sacramento Valley Power Company has purchased the water in North Battle Creek, owned by half a dozen pioneer farmers of the Shingletown region. The sum paid was $100,000. The water was located twenty years ago for farming purposes. The Northern California Power Company also has its power plants on Battle Creek. The Sacramento Valley Power Company proposes using every inch of this water in developing electrical power, thus increasing its output from 3,600 to 15,000 horsepower.

THE DES MOINES EDISON LIGHT COMPANY is about to close a contract for the erection of a new power plant which will represent an expenditure of upward of $175,000, and will result in an increase of sixty-five per cent of the power developed by the company's steam plant. The new plant will be 162 feet long and 135 feet wide and will contain two stories and a basement. The new building will be erected on the river front north of Grand Avenue, and will occupy a part of the site now taken up with the company's buildings.

ALBANY, N. Y.—The Public Service Commission, Second District, has authorized the Dansville Gas and Electric Company to execute a first and refunding mortgage for $125,000, securing the issue of thirty-year five per cent gold bonds. Of these $75,000 is to be set aside to be used for redemption of a like amount of bonds now outstanding; $20,000 bonds is to be sold at not less than par, the proceeds to be used, $9,000 for the discharge of bills payable, $9,000 to be applied in payment of the cost of new extensions and improvements and $2,000 for the purpose of providing a working capital.

KNOXVILLE, TENN.—William T. Lang, of Knoxville, is formulating plans for the organization of the Castle Cotton Mills, Limited, with a capitalization of $1,000,000. He has chosen a site and will build the plant after some ideas gleaned from a visit last year to a model mill property in England. It is proposed to erect the buildings of reinforced concrete. Power for operating the machinery will be obtained from the electrical transmission system of the Knoxville Power Company, which will extend its wires to Knoxville from the waterpower plant on Little Tennessee River.

GALENA, ILL.—The Interstate Light and Power Company, of this city, which was recently incorporated to take over the electric-light plants at Galena, Ill., and Platteville, Hazel Green, Cuba City and Benton, Wis., is letting contracts for a new 3,000-kilowatt steam-electric power plant, to be located at Galena and to supply these towns with light and power. The towns will be connected by a 40-mile pole line running from Galena to Platteville, and a number of intervening zinc and lead mines have also contracted to have power furnished them. Work will begin at once and is expected to be completed by October 1. H. M. Byllesby and Company of Chicago are the engineers.

ELECTRIC RAILWAYS.

(Special Correspondence.)

LEXINGTON, KY.—The Lexington and Interurban Railway Company has let the contract for the construction of the line to Nicholasville, the cost to be $350,000.

WASHINGTON, N. C.—It is reported that the Traction Engineering Company, of New York, now installing an electric-railway system here, will make a proposition to the town to lease the present city electric plant, and operating both as one system, the city to derive reasonable profit thereby. L.

RISING SUN, IND.—At a mass meeting of citizens and traction men, held in this city, arrangements have been made for extending the line of the Cincinnati, Lawrenceburg and Aurora Traction Company from Aurora to Rising Sun. If the two per cent tax asked is voted the work on the road will be begun at once. S.

CHESTER, S. C.—The Southern Power Company is now engaged in overhauling the city electric lines, and will soon be ready to furnish current for all purposes, including contracts for industrial enterprises, several of which it is said will be located in the town on account of the availability of the electric current. L.

FT. WAYNE, IND.—An excellent year's record was made by the Wabash Valley Traction Company, according to the report of Frank Hardy, superintendent of transportation. During the year ending with May 15, ninety-three per cent of the cars arrived and left the terminal points on time. Traction men say the year's record is an exceptionally good one. S.

EVANSVILLE, IND.—Eighty of the 100 union men employed by the Evansville and Southern Indiana Traction Company have gone out on a strike because the company refused to recognize the union and agree to employ none but union men. There has been no violence and the company experienced little difficulty in securing trained men to take the places of the strikers. S.

CLEMSON COLLEGE, S. C.—Clemson College, the state institution of South Carolina, proposes to build a short electric line from the college to Calhoun, for the purpose of making a close and direct connection with the nearest railroad main line. The new road will fill a long-felt want, and will be used for both passenger and freight service, ninety-pound rails being laid along the line. Further extensions of the line may follow. L.

ALBANY, N. Y.—The Upper Broadway Railway Company, of New York city, has been incorporated to operate a double-track street surface railroad in Manhattan, three-and-one-half miles long. From Twelfth Avenue along Manhattan Street to Broadway, to St. Nicholas Avenue, to Fort George Avenue. The company has a capital stock of $750,000, and the directors include Morgan D. Wilson, Arnold F. Wainwright and Charles F. Hedden, of New York city.

ROLLA, MO.—E. E. Young, the promoter of the electric line between Rolla and Cabool, accompanied by H. G. Palmer, chief engineer of the Chicago, Kankakee & Champaign City Railroad, have been making a trip over the proposed route and report themselves pleased over the prospects. The road, according to present indications, will go from Rolla by way of Licking to Houston and thence to Cabool in Texas County, connecting with the Frisco road at Cabool.

INDIANAPOLIS, IND.—The R. W. Garton Company, of Chicago, was awarded a judgment for $9,300 against the Indianapolis & Northern Traction Company for a large installment of insulators. The traction company refused to pay for the insulators because, as alleged, they were improperly annealed and many of them broke, causing the traction company to be damaged to an extent greater than the price of the insulators. It was proven that the traction company was responsible for the design and the breakage. S.

ST. MARYS, OHIO—Samuel Johnson, mechanical engineer, of Elgin, Ill., is preparing plans for the installation of additional machinery at the Western Ohio power house, at St. Marys, Ohio. The completed improvement, it is estimated, will cost $40,000. The power house in St. Marys supplies current for running the cars from Findlay to Dayton and westward from Wapakoneta through St. Marys to Celina and Minster. A portion of the Ohio Traction Company's property is also furnished with current from St. Marys. H.

RICHMOND, VA.—The reorganization committee of the Virginia Passenger and Power Company, recently sold to the Gould interests under a decree of the United States District Court, for $8,500,000, has perfected plans for a thorough rearrangement of the system. The new officers of the company are: President, William Northrop, of Richmond; vice-president, Fritz Sitterding, of Richmond; second vice-president, Henry A. Anderson, of Richmond. Directors, Frank Jay Gould, of New York, chairman; R. Lancaster Williams, of Richmond and Baltimore; Howard Gould, of New York; George Gould, of New York; Douglas Robinson, of New York; Percy M. Chandler, of New York, and C. S. Wheelan, of Philadelphia.

FINDLAY, OHIO—An effort is being made to raise the receivership of the Toledo Urban & Interurban and to extend the Toledo, Bowling Green & Southern from Findlay to Columbus, the work beginning as soon as the removal of the receivership is accomplished. A meeting was held in Findlay last week with the accomplishment of this result in view, and it is hoped the effort will succeed. The line as planned is to run through Kenton and Marysville and connect with an eight-mile road running out of Columbus. H.

PHILADELPHIA, PA.—Theodore Voorhees, first vice-president of the Philadelphia and Reading Railway, states that after the work of track elevation is completed the matter of their electrification will be taken up. Since before the work of abolishing grade crossings was begun the Reading management has had it in mind that with the completion of the elevated line it would probably be desirable, both from the standpoint of operation and of economy, to equip for operation by electricity, at least for the big suburban service.

FORT SMITH, ARK.—The Fort Smith Light and Traction Company is about to enlarge its electric plant by the addition of a 2,500-horsepower cross-compound engine and a 1,850-kilowatt generator, thus doubling its power and light capacity. It was only three years ago that the capacity of the plant was doubled. The cost of the unit will be $43,000. The equipment for the street-car service will also be doubled. The company will spend $110,000 between now and the first of September in double-tracking, ballasting and paving.

PITTSBURG, PA.—It is stated here that the Wabash-Pittsburg Terminal Railroad plans electrification of all its lines east of the Ohio River, as soon as it gets out of the hands of the receiver. The electrification of the Castle Shannon Railroad by the Pittsburg Railways Company will be completed within a few weeks, the connecting of the tracks at the tunnel being the only part yet unfinished. This means a service of a little more than fifteen minutes between Pittsburg and Castle Shannon, and presages electric traction throughout the entire Sawmill Run Valley.

FAIRMONT, W. VA.—The Fairmont and Clarksburg Traction Company is adding seven miles to its system, and will spend $100,000 on improvements and additions. Each end of the line is getting its share. Fairmont is having a line, three miles in length, built from the main portion of the city to the new Fair Grounds on the East Side. Work on the construction, east of the present terminal of the East Park line, has been going on for some time, and the officials feel confident that cars will be in operation before the date of the spring race meeting this month.

PITTSBURG, PA.—The Philadelphia Company, which conducts most of the heating and lighting as well as the transportation facilities of the city of Pittsburg, announces that on July 22 there will be a special meeting of its stockholders for the purpose of increasing the authorized capital stock of the company from $42,000,000 to $47,000,000. Already two of the largest bond houses of New York have agreed to take half of the proposed bond issue of $5,000,000. It is understood that most of the new money obtained will be used in perfecting the transportation and lighting facilities of Pittsburg.

PEORIA, ILL.—Plans are now being made by the Illinois Traction system for a new power plant to be built in East St. Louis on the downstream side of the $2,000,000 bridge that is being built by the company across the Mississippi River at that point. The new plant will be the largest of the system and will furnish power for the southern part of the state. The new plant will have 10,000 horsepower, that can be doubled if necessary. Active work has been started on a new depot which will be built at St. Louis, and which will be one of the finest terminals for an electric line that can be found in the country.

CHATTANOOGA, TENN.—A joint resolution authorizing the consolidation of the Chattanooga Railways Company and the Chattanooga Electric Company has been introduced in both boards of the City Council. In the upper board the resolution has passed two readings and was referred to the Judiciary Committee for further consideration. In the lower board it passed one reading and has been referred to the Streets and Sidewalks Committee. The joint resolution allows either company to purchase the other, or authorizes the organization of a holding company to take over the properties and franchises of the two concerns and operate them as one.

FALL RIVER, MASS.—A complete new system of electrification is to be installed on the Providence, Warren and Bristol branch of the New York, New Haven & Hartford Railroad, and the roadbed is soon to be double-tracked from Fall River to Warren, and from Warren to Bristol. At the recent session of the Rhode Island General Assembly the Providence, Warren and Bristol road, which is controlled by the New Haven Company, was authorized to increase its stock to the maximum of $1,000,000, and this money, or as much of it as is necessary, will be used in installing the same system of electric motive power on the line as the New Haven road uses from New York to Stamford, and which it is soon to install from Stamford to New Haven and ultimately from Providence to Boston.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

KATY, TEX.—The Katy Telephone Company has been organized here by L. W. Clardy and others.

NETTLETON, ARK.—The St. Louis and Southwestern Telephone Company is to install an exchange here.

BARDSTOWN, ARK.—The Bardstown Telephone Company has been organized here by J. M. Ward and others.

STONEVILLE, S. D.—The Stoneville Telephone Company has been incorporated with a capital stock of $25,000.

GETTYSBURG, S. D.—The Potter County Telephone Company has been incorporated with a capital stock of $30,000.

JAMESTOWN, WIS.—The Northwest Telephone Exchange Company is building a new line between Jamestown and Lamoure.

GRINNELL, IOWA—The Interior Telephone Company contemplates the expenditure of $20,000 to $30,000 in general improvement of its lines in and around Grinnell. C.

DES MOINES, IOWA—The Mutual Telephone Company is planning to expend $85,000 in improvements. It will install a semi-automatic switchboard at the Highland Park station. C.

HOUSTON, TEX.—H. E. Huntington is considering the matter of a new million-dollar telephone system in Houston. In this connection it is also stated that the question of adopting the automatic system has been under consideration and there is a chance that, when the plant is built, the automatic system will be incorporated in the specifications.

PARKERSBURG, W. VA.—The West Virginia State Independent Telephone Association has been holding its fourth annual convention here at Chancellor Hotel. There were about 300 telephone men in attendance, including officials and stockholders of the various independent companies in the state, together with the representatives of many manufacturers of equipment.

CHATTANOOGA, TENN.—The Alabama & Tennessee Telephone and Telegraph Company, incorporated under the laws of New Jersey, with a capital stock of $200,000, has filed its charter in the office of the Secretary of State. It is understood this company will take over certain independent lines in Tennessee and Alabama, including the main line at Birmingham, Ala.

INDIANAPOLIS, IND.—The telephone train service now in operation between this city and Cincinnati by the Big Four Railroad has proven so satisfactory the company has decided to at once install the division between this city and St. Louis. The wires are owned by the Western Union Telegraph Company, but the equipment will be purchased in the open market by the company. S.

CHICAGO, ILL.—A contract has been closed for the installation of a telegraph system on the boats of the Chicago and South Haven Steamship Company. The first boat to be equipped will be the City of South Haven, which runs between Chicago and South Haven, Mich. Five boats are operated by the Chicago and South Haven Company, and it is expected that others of the line will be equipped with wireless in the near future. A station is also to be erected at South Haven at once.

SOUTH BEND, IND.—The Willapa Harbor Telephone Company, with headquarters at South Bend, has been organized and the following officers and trustees elected: President, C. S. Gilchrist, Centralia; vice-president, F. A. Hazeltine, South Bend; secretary, John T. Welsh, South Bend; treasurer, H. W. McPhail, Raymond; general manager, W. W. Canon, Centralia. Capital stock, $30,000. The new company has purchased the local South Bend and Raymond systems and also the line to Bay Center.

ST. JOHNSBURY, VT.—H. W. Buchanan of Orleans has sold his entire interest in the independent telephone companies of this vicinity to his immediate associates and retires from the activities of the independent business to devote his whole time to other work. Mr. Buchanan has resigned as president of the People's Telephone Company of Orleans County and also as president of the Vermont and New Hampshire Independent Telephone Association, both positions having been held by him since organization.

PRESCOTT, ARIZ.—The Arizona Overland Telephone Company, lately organized at Prescott, already controls 200 miles of wire and is preparing to extend its long-distance lines at a cost of at least $250,000. Permission has been secured from the government for the running of several of these lines over the forest reserves. It is expected very soon communication will be had between Prescott, Kingman, Seligman, Ash Fork, Williams, Flagstaff, Jerome and the Verde Valley. No attempt will be made at the present time to establish any local telephone system in this city. W. H. Thorpe, the general manager, already is making arrangements for the erection of a large brick building in Prescott, to house the general offices of the corporation.

ELECTRICAL SECURITIES.

Last week Mr. Harriman gave out an interview before leaving for Europe, in which he said the future depended mainly on the outcome of crops. Since then the stock market has shown further strength and advances. The government crop report, issued at the beginning of the week, indicates bountiful crops, consequently as things look now we are heading toward great markets, higher prices for stocks of merit and splendid prospects generally, unless political disturbances or unpleasant commercial surprises, at present undiscernible on the horizon, should suddenly overtake us and upset or convulse conditions. Prices are, in many instances, as high if not higher than before the panic, but they seem likely to do still better.

Dividends have been declared upon the following electrical securities: Detroit Edison Company, an initial quarterly dividend of one per cent on its $5,000,000 capital stock, payable July 15 to stock of record July 1. Interborough Rapid Transit Company; the regular quarterly dividend of two-and-one-quarter per cent, payable July 1 to holders of stock and voting trust certificates of record June 17. The usual semi-annual dividend of $2 a share will be paid July 1 on West End Street Railway preferred stock. Canadian General Electric Company, Limited; a regular quarterly dividend of one-and-three-quarters per cent on the common stock, payable July 1. Portland (Ore.) Railway, Light and Power Company; the regular quarterly dividend of one-and-one-quarter per cent on the preferred stock, payable June 15. Twin City Rapid Transit Company; a quarterly dividend of one-and-three-quarters per cent on the preferred stock of the company, payable on and after July 1 to stockholders of record at the close of business June 15.

ELECTRICAL SECURITIES FOR THE WEEK ENDED JUNE 5.

New York:	*Closing.*
Allis-Chalmers common	15½
Allis-Chalmers preferred	52
American Tel. and Tel. Company	140
Brooklyn Rapid Transit	81⅜
General Electric	160½
Interborough-Metropolitan common	16⅝
Interborough-Metropolitan preferred	45¾
Kings County Electric	126
Mackay Companies (Postal Telegraph and Cable) common	82⅜
Mackay Companies (Postal Telegraph and Cable) preferred	74¼
Manhattan Elevated	146½
Metropolitan Street Railway	21½
New York and New Jersey Telephone	110
Western Union	74¾
Westinghouse Manufacturing Company	85½

The Metropolitan Street Railway, operated by Receivers Joline and Robinson, shows an increase in gross receipts for May of $11,000, compared with the corresponding month of last year.

Boston:	*Closing.*
Edison Electric Illuminating	247½
Massachusetts Electric	—
New England Telephone	133
Western Telephone and Telegraph pref.	88

Gross earnings of the Massachusetts Electric Companies for May showed an increase of about $5,000, or three-fourths per cent. The Boston & Northern gross decreased one-and-one-half per cent, or $6,700, while the Old Colony gross gained $11,700, or five per cent. The dropping off in Boston & Northern earnings was the result of comparison with May a year ago, when the Chelsea fire riding proved such a powerful stimulus to earnings. The gain of three-fourths per cent in May compares with an April gain of but $1,600, or a trifle over one-third per cent, and a March increase of $21,800, or 4.4 per cent. Decoration Day was the biggest in the history of the Massachusetts Electric lines, a total of 850,000 five-cent fares being collected.

Philadelphia:	*Closing.*
Electric Company of America	12½
Electric Storage Battery common	53
Electric Storage Battery preferred	53
Philadelphia Electric	11⅞
Philadelphia Rapid Transit	32½
United Gas Improvement	88⅜

Chicago:	*Closing.*
Chicago Telephone	133¼
Commonwealth Edison	119¾
Metropolitan Elevated preferred	53
National Carbon common	93
National Carbon preferred	116

The Chicago Railways Company's earnings for May increased 16.9 per cent.

South Side Elevated traffic in May decreased 2.3 per cent, while the Northwestern Elevated increased 6.7 per cent.

Commonwealth Edison actually touched 120, which places it on the 5 per cent basis.

NEW PUBLICATIONS.

REPORT ON TELEPHONE RATES IN CHICAGO—The report to the commissioner of public works and the city comptroller of Chicago, on regulation of rates under the telephone ordinance of November 6, 1907, by D. C. and W. B. Jackson, engineers, and Arthur Young and Company, certified public accountants, has been printed in book form. The report, which occupies seventy-nine pages, covers the question of suitable apportionment of plant and operating costs, of record keeping and accounting, to be adopted by the Chicago Telephone Company for the purpose of affording information to the city officials in regard to the equitableness and reasonableness of the charges for telephone service in each class which comes within the schedule of rates mentioned by the company under the above ordinance.

PUBLIC SERVICE COMMISSION REPORTS—The State of New York Public Service Commission has just issued a series of reports of the opinions of the Commission in regard to various reports, applications and complaints brought before it, among them: The application of the Dexter & Northern Railway Company for a certificate of public convenience and necessity; the complaint of the citizens of Washington County against the Greenwich & Johnsonville Railway Company; fire prevention along the lines of the railways in the Adirondack forest preserve; the Ogdensburg Roller Mills, Bill, Bell and companys and George A. Taylor & Co. against the Rutland and the Delaware & Hudson railway companies; the application of the Buffalo, Rochester & Eastern Railway Company for a certificate of public convenience and necessity.

DOMESTIC ENGINEERING DIRECTORY FOR 1909—Domestic Engineering, the well-known weekly trade journal published in Chicago in the interests of the plumbing, heating, lighting and mill-supply trades, has issued its 1909 Directory, published separately in English and Spanish. This is a reliable "who's who" of practically all the best firms in the country, manufacturing every conceivable article under the above classifications. The English edition contains 335 pages, and the Spanish edition 298 pages. The firms are arranged alphabetically under the specialties manufactured by them, which are also in alphabetical order. A copious index is provided for reference.

OBITUARY.

MARK W. WATSON, president of the Standard Underground Cable Company and president of the Exchange National Bank of Pittsburg, died last week. He was also president of the Monongahela Water Company and a director of the Pittsburg & Lake Erie and of the Pittsburg, McKeesport & Youghiogheny Railroad Company.

DR. BINDON BLOOD STONEY, a well-known British engineer, died at Dublin on May 5, in his eighty-first year. Dr. Stoney was a fellow of the Royal Society of London, a Telford medallist of the Institution of Civil Engineers, and author of the well-known textbook, "The Theory of Stresses and Strains," which was a standard book for many years.

CHARLES W. DOUGLAS, a veteran railroad official, died at Wayne, N. J., on May 31, at the age of seventy-five years. At the age of thirteen Douglas left a printer's office to learn telegraphy, and while serving as Erie operator at Addison, N. Y., surprised the management by his ability to abandon the tape and take messages by sound. This was the first feat of the kind in the country.

IRVING LOVERIDGE, of the Western Electric Company, died at Berlin, Germany, on June 3. He was the general superintendent in Europe of the company. Death was caused by influenza complicated with weakness of the heart. Mr. Loveridge, who made his headquarters at the Hotel Savoy, London, was in Berlin on an annual inspection tour of the company's continental offices. He caught a chill at Antwerp, but his death was quite unexpected. Mr. Loveridge had lived in London since January 1.

CHARLES LUMAN BUCKINGHAM died May 31 at his home at 104 East Eighty-first Street, New York city. He was born at Berlin Heights, Ohio, on October 14, 1852, and educated at the University of Michigan and Columbia University. He was counsel for the General Electric Company, the Westinghouse Electric and Manufacturing Company, the Edison companies, the Atlantic Telegraph and Telephone Company and many others. He made a specialty of patent laws and was one of the counsel, in the suits over the famous Tesla patents. He was also counsel for the Western Union in many of its important patent suits in the early '80s. He was a member of the Ohio Society, the Metropolitan Club of Washington and the University Club.

PERSONAL MENTION.

DR. ERNEST MERRITT, professor of physics at Cornell, has been appointed dean of the University's graduate school.

E. A. DELANO, of Chicago, president of the Wabash Railroad, has been re-elected president of the American Railway Association for another year.

A. W. BURCHARD, of the General Electric Company, who is at present abroad, will travel in several European countries before returning home in July.

ALFRED A. WOHLAUER, consulting electrical engineer, New York city, announces his removal to 546 Fifth Avenue, at the corner of Forty-fifth Street.

R. C. McMILLAN, the new chief statistician of the Buffalo General Electric Company, was formerly assistant statistician with the Commonwealth Edison Company in Chicago.

H. SWANSON, of St. Paul, Minn., electrician of the Northwestern Electrical Company, was married in Chicago last week to Miss Edith Johnson.

E. W. CARTER has been appointed New England manager of the Hoyt Electrical Instrument Works, Penacook, N. H., in place of R. M. Merritt, who resigned to become associated with the Wetmore-Savage Company of Boston.

CHARLES DOOLITTLE WALCOTT, secretary of the Smithsonian Institution, Washington, D. C., has been recommended for the honorary degree of Doctor of Science by the University of Cambridge, England, to be conferred on the occasion of the forthcoming Darwin centenary celebrations.

MARTIN J. INSULL, manager of the Louisville & Northern Railway and Lighting Company, has been appointed to the position of operating manager of the Indianapolis and Louisville Traction Company. Mr. Insull succeeds J. S. Kuhn, who will return to Pittsburg. Mr. Insull will retain his office at New Albany, Ind. S.

W. H. WISSING, formerly of the Union Electric Light and Power Company, St. Louis, will take charge of the central-station campaigns of the Tungstolier Company, Cleveland, Ohio, beginning his new duties on June 15. Mr. Wissing has been one of the most successful central-station men of recent times, and he will be a tower of strength to this excellent organization.

DR. ROBERT W. WOOD, professor of experimental physics in the Johns Hopkins University, has been voted the Rumford premium, a gold and a silver medal, by the American Academy, for his discoveries in light, particularly for his researches on the optical properties of sodium and other metallic vapors. The medals will be prepared during the coming summer. The Rumford premium is awarded annually, and is given for important investigations in the domains of light and heat. It was founded by Count Rumford, who also established the Rumford professorship in Harvard University and founded the Royal Institution in London, selecting Sir Humphrey Davy as the first lecturer there.

J. R. BIBBINS, who since 1902 has been associated with the Westinghouse interests at Pittsburg, Pa., will become associated after June 18 in the work of the Public Service Commission of New York as assistant to B. J. Arnold, consulting engineer and director of appraisals. Mr. Bibbins is a graduate of the University of Michigan and has served in various technical capacities with the Detroit Public Lighting Commission, the Detroit Edison Company and the Detroit United Railways Company, in operating and construction work. During his late connection with the Westinghouse Machine Company, Mr. Bibbins' work has included an intimate association with the development of prime movers at East Pittsburg, including gas engines, producers, turbines and condensers. His new offices will be in the Tribune Building, City Hall Square, New York, N. Y.

PROPOSALS.

POST OFFICE, CORSICANA, TEX.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., July 6, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Corsicana, Tex., in accordance with drawings and specification, copies of which may be had from the custodian of site at Corsicana, Tex., or at the Supervising Architect's office.

POST OFFICE, VERSAILLES, KY.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., July 1, 1909, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Versailles, Ky., in accordance with drawings and specification, copies of which may be obtained from the custodian of site at Versailles, Ky., or at the Supervising Architect's office.

POST OFFICE, WINCHESTER, VA.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., July 12, 1909, for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the U. S. Post Office at Winchester, Va., in accordance with drawings and specification, copies of which may be obtained from the custodian of site at Winchester, Va., or at the Supervising Architect's office.

WEST POINT, N. Y.—Sealed proposals, in triplicate, will be received at West Point until twelve o'clock, noon, June 21, 1909, for furnishing and installing electric and combination gas and electric-light fixtures in the Post Headquarters Building, as per drawings and specifications in this office. The United States reserves the right to accept or reject any or all proposals or any part thereof. Forms for proposals will be furnished upon application. Address Quartermaster, West Point, N. Y.

INDUSTRIAL ITEMS.

THE HOLOPHANE COMPANY, Chicago, Ill., has issued a folder describing reflectors for tungsten, tantalum and Gem lamps. The intensive, extensive, focusing and meridian types of reflectors are described and illustrated, and the classes of interiors for which these are best suited are clearly set forth.

ROTH BROS. & COMPANY, of Chicago, have recently furnished to A. C. McClurg & Company about ten motors for their North Side printing and bookbinding plant. They have also furnished to the Juergens Bros. Company, 167 West Adams Street, a large number of motors for driving electrotyping machinery.

THE CASTOLIN COMPANY, St. Louis, Mo., has issued a pamphlet describing the "Castolin" process, which is claimed to be the only easy and reliable way of brazing cast-iron, and which does not require any special appliances. Cast-iron brazed by this process has given tensile breaking strains, it is said, of seven-and-one-half tons per square inch.

THE GENERAL ELECTRIC COMPANY is exhibiting, at the Indianapolis Heat and Light Company's office, in Monument Street, Indianapolis, every kind of kitchen and household utensil that can be operated by electricity. The exhibit is so complete that those who witness it no longer doubt that electricity will soon supplant all other forms of heat and power for cooking and laundry work.

THE OKONITE COMPANY, New York city, has issued an instructive folder giving an account of the formation and objects of the National Board of Fire Underwriters' Laboratories. All the insulated wire manufactured by the Okonite Company is passed by the Underwriters' Laboratories before being put on the market, and is labeled with the official "Tested and Inspected" stamp of the laboratories.

THE WESTERN ELECTRIC COMPANY, Chicago, has published a pamphlet entitled "First Rateau Regenerator Installed in America," by F. G. Gaesche, which is reprinted from *Power*, June, 1907. This is an account of a low-pressure steam-turbine and regenerator on the system devised by Professor Rateau, installed in the works of the International Harvester Company, of Chicago, Ill. Interesting illustrations of Western Electric Company's switchboards at the Indiana Steel Company's plant at Gary, Ind., and of large dynamo-electric units, make up the pamphlet, which is remarkable for the excellence of the printing and illustrations.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY, of Chicago, has ready for distribution its new bulletin No. 4, which is devoted to tungsten fixtures and accessories. Among the fixtures catalogued and illustrated are: Tungsten arcs, with and without the center lamp, open or enclosed, pendent or ceiling type; tungsten wireless clusters of the reflector and dome styles; arc bursts and Holophane arcs; weatherproof one-light brackets, and tungsten street-lighting arcs of both the mast-arm and suspension types. The accessories listed are: Clusters, socket extensions, one-light and two-light adapters. Most of these fixtures have become so well known as to require little or no description; however, photometric curves for the tungsten arc and cluster fixtures are given.

THE STANDARD ELECTRIC ACCUMULATOR COMPANY, New York city, has issued a catalogue of S. E. A. batteries for operating elapse-time machines. A battery of twenty-three of these cells to operate thirty-three clocks weighs 250 pounds and occupies a rack measuring 12x42x48 inches. An equipment consists of two of these batteries, the object being that while one battery is operating the elapse-time machines the other is charging; so that when the first battery has been in operation for seven days the machines can be switched on to the second battery without any loss of time, and the first battery be started recharging immediately. Instructions for the care and operation of these batteries are included in the catalogue, besides the method of charging from a direct-current lighting system, and other useful information.

THE CORRUGATED BAR COMPANY, St. Louis, Mo., is publishing a series of bulletins on "Designing Methods for Reinforced Concrete Construction." The first of these appeared in May, 1908, and up to the present seven numbers have been issued. Each number is devoted to a particular type of structure, the problems relating to which are discussed in full, the complete analysis often being given, as well as an illustrative worked-out example in the form of a typical detailed design. The methods adopted are excellent and full use is constantly made of the latest researches and experiments on the subject of concrete design, much of which information is unobtainable from any

existing textbook. The subjects so far treated are: (1) Buildings—General Principles of Design; (2) Buildings—Detailed Design of Typical Building; (3) Bridges and Culverts for Highway Traffic; (4) Standard Designs for Bridges and Culverts; (5) Retaining Walls; (6) Reservoirs; (7) Conduits and Sewers. The next bulletin (Vol. 1, No. 8) will treat of Semicircular Arches, and is announced for this present month. So great has been the demand for these bulletins, which comprise the last word in concrete construction, that several of them have had to be reprinted to supply the demand.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., has recently issued Bulletin 114, describing coupled types of alternating-current generators. This publication supersedes Bulletin 77 and gives some interesting examples of large sizes of coupled alternators made by the company for power stations, in which it was found impracticable to have the prime mover mounted on the same shaft with the generator. The Crocker-Wheeler Company is installing squirrel-cage induction motors, totaling 2,200 horsepower, at the Bonnie Cotton Mills, Kings Mountain, N. C. Two ten-kilowatt Crocker-Wheeler transformers stepping down from 2,200 to 110 volts will also be installed in this plant. Other large orders are also announced, including one for twenty-one Form W rolling-mill motors, aggregating 665 horsepower, for the Indiana Steel Company, Gary, Ind.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, held its annual convention at the Bellevue-Stratford Hotel on May 27, 28 and 29 last. During the convention, presided over by President Herbert Lloyd, papers were read by Charles Blizzard, third vice-president; J. Lester Woodbridge, chief engineer; Carroll Hodge, manager of construction; Joseph Appleton, consulting engineer, and Converse D. Marsh. A pleasant feature of the affair was the presentation of a matchsafe, knife and pencil, made by the Bailey, Banks & Biddle Company, to Charles Blizzard, third vice-president. Two years ago the same conference presented Mr. Blizzard with a gold watch and chain. The following managers from the different sales offices were in attendance: New York, Albert Taylor; Boston, Frank J. Stone; Chicago, G. H. Atkin; St. Louis, H. B. Marshall; Cleveland, H. B. Gay; Atlanta, H. H. Seaman; San Francisco, R. B. Daggett; Pennsylvania, E. L. Reynolds. The meeting adjourned on May 29 to reconvene at Atlantic City during the convention week of the National Electric Light Association.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the second issue of each month.)

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary, Lloyd Lyon, secretary and auditor Mobile Light and Railway Company, 158 Government Street, Mobile, Ala.

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS. Secretary, W. H. Tapley, 29 West Thirty-ninth Street, New York, N. Y.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Dr. J. W. Richards, Bethlehem, Pa.

AMERICAN ELECTROTHERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, 352 Willis Avenue, New York city.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Dr. Richard Moldenke, Watchung, N. J.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-ninth Street, New York city. Annual convention, Thousand Islands, N. Y., June 28.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, Rossiter W. Raymond, 29 West Thirty-ninth Street, New York city.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West 116th Street, New York city.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill. Annual convention, Atlantic City, June 16-18.

AMERICAN ROENTGEN-RAY SOCIETY. Secretary, Dr. G. C. Johnson, 514 Bijou Building, Pittsburg, Pa.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 39 West Twenty-ninth Street, New York city.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West Forty-seventh Street, New York city.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, A. P. Folwell, Flatiron Building, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, secretary and treasurer Tri-City Railway Company, Davenport, Iowa.

AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION. Secretary, B. B. Davis, claim agent Columbus Railway and Light Company, Columbus, Ohio.

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, J. W. Corning, electrical engineer Boston Elevated Railway Company, Boston, Mass.

AMERICAN STREET AND INTERURBAN RAILWAY TRANSPORTATION AND TRAFFIC ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS' ASSOCIATION. Secretary, George B. Keegan, 2321 Park Row Building, New York city.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, J. E. Cowles, superintendent of lighting Hot Springs Light and Railway Company, Hot Springs, Ark.

ARKANSAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Ark.

ASSOCIATION OF CAR-LIGHTING ENGINEERS. Secretary, G. B. Colegrove, Illinois Central Railroad, Chicago, Ill.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, D. L. Huntington, second vice-president and manager Washington Water Power Company, Spokane, Wash.

ASSOCIATION OF EDISON PURCHASING AGENTS. Secretary, J. W. Brennan, Edison Illuminating Company, Detroit, Mich.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, Welles E. Holmes, 308 Washington Street, Newton, Mass.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Wisconsin Central Railway, Chicago, Ill. Annual convention, Detroit, Mich., June 23-25.

CALIFORNIA ELECTRIC RAILWAY ASSOCIATION. Secretary, L. E. W. Pioda, Oak and Broderick streets, San Francisco, Cal.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, Toronto, Canada. Annual convention, Quebec, Canada, June 16-18.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Acton Burrows, 33 Melinda Street, Toronto, Ontario.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Traction Terminal Building, Indianapolis, Ind.

CENTRAL ELECTRIC TRAFFIC ASSOCIATION. Secretary, J. T. Brittson, assistant claim agent Chicago, South Bend & Northern Indiana Railway Company, South Bend, Ind.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, J. C. Lawler, Colorado Springs, Colo.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, F. W. Poole, Bridgeport, Conn.

ELECTRIC CLUB OF CHICAGO. Secretary, Wm. S. Taussig, 204 Dearborn Street, Chicago, Ill.

ELECTRIC CLUB OF CLEVELAND. Secretary, George L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

ELECTRICAL CLUB OF CALIFORNIA. Secretary, Russell D. Holabird, Argonaut Hotel, San Francisco, Cal.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, George William Russell, Jr., 500 Fifth Avenue, New York city.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine Street, St. Louis, Mo.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings, second and fourth Thursday of each month.

ELECTRICAL TRADES ASSOCIATION OF CANADA, LIMITED. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Canada.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, San Francisco, Cal. Monthly meetings, San Francisco, Cal., first Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary Franz Neilson, 80 Wall Street, New York city. Board of directors meets second Friday of each month.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 154 Nassau Street, New York city.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt Street, New York city.

ENGINEERS' CLUB OF PHILADELPHIA. Secretary, H. G. Perring, 1317 Spruce Street, Philadelphia, Pa.

ENGINEERS' SOCIETY OF MILWAUKEE. Secretary, W. Fay Martin, Milwaukee, Wis.

ILLINOIS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. A. Camp, Henry, Ill.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Ottawa, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Preston S. Millar, Engineering Societies Building, 33 West Thirty-ninth Street, New York city.

INDEPENDENT TELEPHONE ASSOCIATION OF TEXAS AND LOUISIANA. Secretary, C. A. Shock, Sherman, Tex.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Frederic Leslie, Muncie, Ind. Next meeting, August 18.

INDIANA INDEPENDENT TELEPHONE ASSOCIATON. Secretary, Allen J. Paylow, Rockport, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Annual convention, Atlantic City, N. J., September 14-16.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. C. Davis, Parkersburg, W. Va.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Des Moines, Iowa.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. Thill, Des Moines, Iowa.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Iowa.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. G. Turpine, Henderson, Ky.

MAINE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, M. E. Crow, Houlton, Me.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress Street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby Street, Boston, Mass. Meets second Wednesday of each month, except July and August.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill. Annual convention, Atlantic City, June 21-23.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich.

MICHIGAN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. A. Burch, Battle Creek, Mich.

MILWAUKEE SOCIETY OF ENGINEERS. Secretary, W. Fay Martin, 456 Broadway, Milwaukee, Wis.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-treasurer, B. W. Copperthwait, Faribault, Minn.

MISSISSIPPI ELECTRICAL ASSOCIATION. Secretary, J. Abbott, manager Jackson Electric Railway, Light and Power Company, Jackson, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATERWORKS ASSOCIATION. Secretary, Claude L. Clary, Sikeston Electric Light and Power Company, Sikeston, Mo.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, George W. Schwerer, Windsor, Mo.

MUNICIPAL LIGHTING ASSOCIATION OF MASSACHUSETTS. Secretary, J. C. Norcross, Reading, Mass.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Annual convention, Toledo, Ohio, July 21-23.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago, Ill.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, Frank M. Tait, Dayton, Ohio.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, William Bradford, Lincoln, Neb.

NEBRASKA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. E. Mattison, Lincoln, Neb.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 60 State Street, Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl Street, Boston, Mass. Meetings held on fourth Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary G. H. Guy, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

NEW YORK RAILROAD CLUB. Secretary, H. D. Vote, 95 Liberty Street, New York, N. Y.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary R. Max Eaton, Niagara Falls, N. Y.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary-treasurer, John E. Allen, manager Equitable Electric Light Company, Lake Geneva, Wis.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention, Toledo, Ohio, July 13-15.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, O. O. Welsheimer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, David Gaehr, Schofield Building, Cleveland, Ohio.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron, Ohio.

OKLAHOMA ELECTRIC LIGHT, RAILWAY AND GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD-TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, Frank J. Scherrer, 195 Broadway, New York city. Annual reunion, Pittsburg, Pa., August 17-19.

ORDER OF THE REJUVENATED SONS OF JOVE. Mercury, C. B. Roulet, Dallas, Tex.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, Dr. Henry M. Stein, Harrisburg, Pa.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Leanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Colo. Meetings, second Saturday of each month.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. C. Rosenberg, Bethlehem, Pa. Next annual meeting, Louisville, Ky., October 12-14, 1909.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, C. E. Russell, Boston, Mass.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, J. G. White & Company, New York city.

TEXAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, T. A. Gould, Ennis, Tex.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 55 Kilby Street, Boston, Mass.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. B. Seeley, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Vt.

VIRGINIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, B. L. Fisher, Rocky Mount, Va.

WESTERN SOCIETY OF ENGINEERS (Electrical Section). Chairman, William B. Jackson, 115 Adams Street, Chicago, Ill.; secretary, J. H. Warder, Monadnock Block, Chicago Ill.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 382 Ohio Street, Chicago, Ill.

WISCONSIN ELECTRIC AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Clement C. Smith, president Columbia Construction Company, Milwaukee, Wis.

WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. C. Crowley, Jr., Superior, Wis.

DATES AHEAD.

Mississippi Electrical Association. Annual convention, Jackson, Miss., June 15.

American Railway Master Mechanics' Association. Annual convention, Atlantic City, N. J., June 16-18.

Canadian Electrical Association. Annual convention, Quebec, Canada, June 16-18.

Master Car Builders' Association. Annual convention, Atlantic City, N. J., June 21-23.

Association of Railway Telegraph Superintendents. Next meeting, Detroit, Mich., June 23.

American Institute of Electrical Engineers. Annual convention, Thousand Islands, N. Y., June 28.

Ohio Electric Light Association. Annual convention, Toledo, July 13-15.

National Electrical Contractors' Association. Annual convention, Toledo, Ohio, July 21-23.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 18-22.

International Municipal Electricians' Association. Convention, Atlantic City, N. J., August.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) June 1, 1909.

923,133. ELECTRIC TRAVELING CRANE. Edgar E. Brosius, Alliance, Ohio, assignor to the Morgan Engineering Company. Filed February 21, 1908. The main trolley is provided at its outer side with an overhanging motor-driven hoisting drum.

923,147. COMBINED ELECTRICAL PIANO PLAYING AND RECORDING ATTACHMENT. George H. Davis, West Orange, N. J. Filed November 26, 1901. An automatic playing mechanism with electrical contact fingers produces a perforated sheet constituting a record of music played manually on the instrument.

923,157. STARTING DEVICE FOR ELECTROMOTORS. Karl von Dreger, Berlin, Germany. Filed May 23, 1908. A handle for switching on or off is connected by a spring to a drum carrying insulated contact springs.

923,170. SIGNAL SYSTEM. Laurence A. Hawkins, Schenectady, N. Y., assignor to General Electric Company. Filed November 2, 1908. A signal is controlled by a selenium cell (or cells) exposed to a variable light directed across the track.

923,179. SEPARABLE ATTACHMENT-PLUG. Harvey Hubbell, Bridgeport, Conn. Filed October 30, 1908. An insulating disk, and a screw shell attached to this and enclosing an insulating body, are provided with slots for the passage of contact plates and contact springs.

923,185. CIRCUIT-CLOSER FOR RECORDING-ANEMOMETERS. Jess C. Jurgensen, Tappan, N. Y. Filed March 9, 1908. A metallic ball travels in a groove in a wheel, and a ball catcher has a throat (contined in a chute to deposit the ball in the groove at a lower point) provided with contacts arranged in the path of the ball.

923,186. AUTOMATIC MOTOR CONTROL. Sam H. Kanmacher, Schenectady, N. Y., assignor to General Electric Company. Filed October 15, 1906. The controlling switch is biased to the off position, and is held to the on position by a locking coil, and an overload relay interrupts the current through the latter when an excessive current flows through the motor.

923,194. CURRENT-COLLECTOR FOR ELECTRIC CARS. Gustav Mertens, Blasewitz, near Dresden, Germany. Filed February 12, 1908. The customary trolley wheel is replaced by a wide, flat, longitudinally curved collector bar.

923,202. RELAY AND METHOD OF MAKING THE SAME. Jesse S. Pevear, Schenectady, N. Y., assignor to General Electric Company. Filed August 24, 1907. The current-carrying coil is made by cutting spirally through a tube of conducting material, pressing longitudinally the coil so formed, and allowing the coil to assume its natural position.

923,228. METHOD OF INSULATING SHEET METAL. Willis R. Whitney, Schenectady, N. Y., assignor to General Electric Company. Filed February 28, 1907. The process consists in treating a conductor with a suspension of gum copal in water and then baking to remove the water and melt the copal into a homogeneous coating.

923,247. RELAY. Archibald S. Cubitt, Schenectady, N. Y., assignor to General Electric Company. Filed May 22, 1908. The actuating coil of the relay is energized from the motor circuit of a motor-control system.

923,284. SOCKET-LOCK FOR INCANDESCENT LAMPS. Abbott L. Lowe, Denver, Colo. Filed May 13, 1907. Has a locking pin adapted to enter an opening in the neck of the lamp.

923,296. AUTOMATIC ELECTRIC BLOCK-SIGNAL SYSTEM. Harold W. Price, Toronto, Ontario, Canada, assignor of one-half to Allan McPherson, Longford Mills, Canada, and one-half to William Ruston Percival Parker, Toronto, Canada. Filed March 21, 1907. Means are provided whereby a train on one block shall cause danger-signal connections to be half set at the two block junctions next ahead and the two next behind it.

923,297. AUTOMATIC TRAIN-CONTROLLING AND SIGNALING MECHANISM FOR BLOCK-SIGNAL SYSTEMS. Harold W. Price, Toronto, Ontario, Canada, assignor of one-half to Allan McPherson, Longford Mills, Canada, and one-half to William Ruston Percival Parker, Toronto, Canada. Filed March 21, 1907. In combination with the engineer's brake valve are an electrically started, pneumatic, service-application means, and a retarding device in the air-operated means.

923,311. ELECTRIC MOTOR. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed March 1, 1907. Has a field magnet with polar projections and main field coils in the interpolar spaces, a compensating winding on the pole faces, an armature with a commutator, and armature coils having a fractional pitch equal to the breadth of the pole faces.

923,312. SINGLE-PHASE-MOTOR CONTROL. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed August 6, 1908. The controller is arranged to connect the motor to the source of current as a series-connected motor both for starting and for running, and to vary the voltage impressed on the motor for operation at different speeds, and means are provided to short-circuit the motor armature when starting under heavy load.

923,327. ELECTRICAL-CONNECTION ROSETTE. James L. Burton, Plainville, Conn., assignor of one-half to Frank A. Champlin, East Long Meadow, Mass. Filed October 17, 1908. Yieldable contacts in the upper and the lower members are engaged when these members are brought together by operating a coupling device provided for the purpose.

923,338. GROUND-LEG CONNECTION FOR ELECTROLYTIC ARRESTERS. Elmer E. F. Creighton, Schenectady, N. Y., assignor to General Electric Company. Filed July 9, 1907. In combination with the line conductors of a transmission system are an electrolytic condenser in each phase leg of the multiplex connection, and an auxiliary condenser of smaller capacity in the ground leg of the connection.

923,358. NON-CONDUCTING COMPOUND. Franc J. Jewett, New York, N. Y., assignor to H. W. Johns-Manville Company. Filed May 8, 1906. Consists of short asbestos fiber, granulated cork treated with boracic acid, disintegrated sponge treated with a boron compound, and infusorial earth.

923,385. TELAUTOGRAPH. George S. Tiffany, Summit, N. J., assignor to The Gray National Telautograph Company, New York, N. Y. Filed July 6, 1906. The relays are adjusted conjointly with the movements of the receiving pen.

923,439. ELECTRIC CUT-OUT. Thomas E. Murray, New York, N. Y. Filed January 13, 1909. The base has two recesses containing fuse cases and circuit connections, and means are provided for removing both fuse cases simultaneously.

923,535. JUMP-SPARK PLUG FOR EXPLOSION-ENGINES. William W. King, Huntsburg, Ohio. Filed November 2, 1906. A longitudinal firing pin and a metal plug form the terminals.

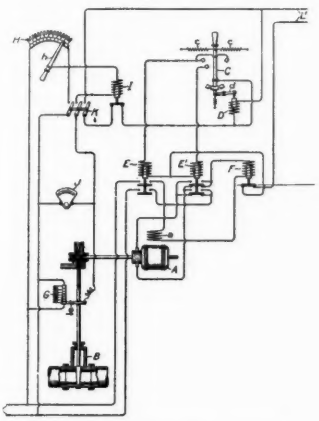
923,540. TROLLEY. Herrmann Lietz, Pittsburg, Pa. Filed January 9, 1909. Has replacer arms pivotally carried by the sides of the harp.

923,566. COMBINED VIBRATOR AND TIMER. William S. Newcomet, Philadelphia, Pa. Filed August 24, 1908. A device moving with a rotatable member shifts one contact and maintains the other contact stationary.

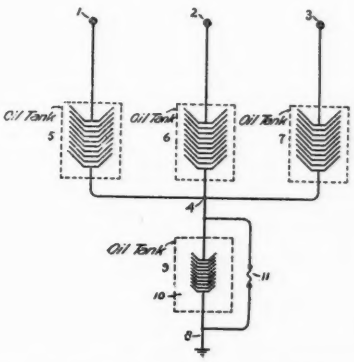
923,581. PROCESS FOR THE PRODUCTION OF CARBON-COVERED METAL SHEETS FOR DYNAMO-BRUSHES. Johannes F. P. Ringsdorff, Essen-on-the-Ruhr, Germany. Filed July 14, 1908. A graphite paste is smeared on the surfaces of the sheets, which are then subjected to hydraulic pressure.

923,597. ELECTRICAL CONTROLLER. Harry A. Steen, Edgewood, and Alexander J. Loguin, Wilkinsburg, Pa., assignors to Westinghouse Electric and Manufacturing Company. Filed September 3, 1907. A stop device serves to prevent further movement of the arm until a latch is released and again manually actuated.

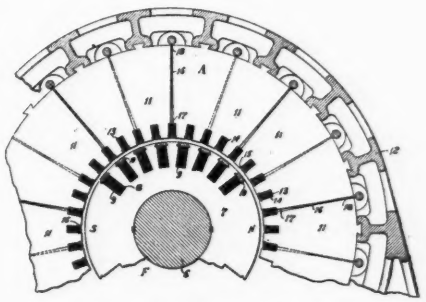
923,598. INSULATED HANGER. Louis Steinberger, New York, N. Y. Filed April 28, 1903. A bell-shaped body supports within it insulating material, embedded in which is a bolt with an extending threaded portion.



923,186.—AUTOMATIC MOTOR CONTROL.



923,338.—GROUND-LEG CONNECTION FOR ELECTROLYTIC ARRESTERS.



923,614.—ARMATURE CONSTRUCTION.

923,442. TIMER AND DISTRIBUTER. Harry L. Radford, Orange, Mass., assignor to Grout Brothers Automobile Company, Orange, Mass. Filed August 9, 1905. Describes a rotary make-and-break spark-timing device for internal-combustion engines.

923,466. COMBINED FUSE AND SWITCH BOX. Willis R. Vanaman, Atlantic City, N. J. Filed June 10, 1908. Comprises a fixed and a movable element, terminal blocks carried by the fixed element, cushioned contact blocks carried by the movable element, and means operatively connected with the contact blocks for receiving and clamping to place a fuse between the contact blocks.

923,484. SUPPORT FOR CONTACT-PLOWS. Samuel T. Bole, Philadelphia, Pa., assignor to The J. G. Brill Company. Filed June 24, 1908. Freely slidable means support the plow from a device connecting hangers which are supported from transoms connected to top chords.

923,488. PRINTING-TELEGRAPH. Harcourt W. Bull, Springfield, Mass. Filed April 17, 1908. An electromagnet is arranged to move the receiving cylinder through a predetermined distance upon the transmission of electrical impulses over the line.

923,499. SIGNALING MEANS FOR TELEPHONE SYSTEMS. Frederick S. Davenport, Atlanta, Ga. Filed April 30, 1907. A manually operated device intermittently short-circuits the line wires to charge and discharge condensers and thereby ring the signal bells in series with them.

923,508. VIBRATOR. Maximilian K. Golden, San Francisco, Cal., assignor to James Jerome, San Francisco, Cal. Filed March 28, 1908. Describes a form of electrical vibrating apparatus.

923,511. CHECKING APPARATUS FOR SYNCHRONOUSLY-RUNNING KINEMATOGRAPHS AND TALKING-MACHINES. Jules Greenbaum, Berlin, Germany. Filed September 17, 1907. Pointers arranged like the hands of a clock indicate to the attendant when the two machines are working synchronously.

923,601. TROLLEY-STAND. Emmett W. Stull, Norwood, Ohio, assignor to Allis-Chalmers Company. Filed February 13, 1908. A crosshead is normally fixed relatively to the base, but movable relatively thereto when the trolley arm is moved above a predetermined altitude.

923,603. TELEPHONE APPARATUS. Warren H. Taylor, Stamford, Conn. Filed August 22, 1908. In combination with a telephone set are an auxiliary magneto receiver, a flexible cord connecting the terminal of the auxiliary receiver with the terminals of the main receiver, a ring to engage the mouthpiece of the transmitter, and means for connecting the ring and auxiliary receiver whereby the latter will be removably supported.

923,606. RECORDER FOR ELECTRICAL MEASURING INSTRUMENTS. Charles B. Thwing, Philadelphia, Pa. Filed June 29, 1908. The printing device is moved against the inking means when the circuit is open, and against the recording surface when the circuit is closed.

923,614. ARMATURE CONSTRUCTION. Bernard A. Behrend, Norwood, Ohio, assignor to The Bullock Electric Manufacturing Company and Allis-Chalmers Company. Filed September 19, 1904. The core is built up of segmental laminæ, with portions of the adjacent edges of the segments of a single layer cut away in such a manner that the magnetic path for the flux between the field-magnet poles has substantially uniform reluctance through the armature core.

923,615. DYNAMO-ELECTRIC MACHINE. Bernard A. Behrend and Emil Mattman, Norwood, Ohio, assignors to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed March 31, 1906. Describes an air-ventilated rotor.

923,627. VOLTAGE-REGULATOR. Frank Conrad, Swissvale, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed January 5, 1907. An exciter generator has a

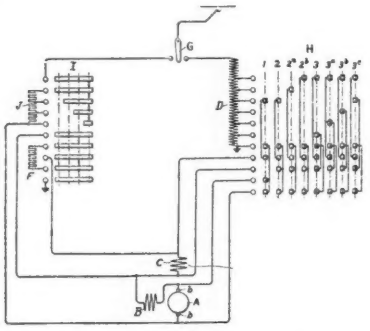
main field-magnet winding and two auxiliary field-magnets arranged to act in opposition, and means for causing the one or the other of the auxiliary windings to act in conjunction with, or in opposition to, the main winding.

923,637. TELEPHONE APPLIANCE. Marcus P. Flack, New York, N. Y. Filed December 16, 1908. A tapered supporting member is clamped to and encircles the mouthpiece of a telephone transmitter, and has fitting snugly on it a sound collector and screen.

923,653. AIR OR WATER BLAST MAGNET. John D. Hilliard, Jr., and Charles E. Parsons, Glens Falls, N. Y. Filed January 29, 1906. Describes a lifting magnet having an apertured core, an apertured shell surrounding the core, and means for feeding a cleaning fluid through both, against the article to be acted upon by the magnet.

923,666. PROTECTIVE DEVICE FOR COMMUTATOR-TYPE ALTERNATING-CURRENT MOTORS. Benjamin G. Lamme, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed June 30, 1904. An interrupter for the field-magnet circuit is provided with means to quickly open this circuit a predetermined interval of time after the armature circuit is broken.

923,667. WINDING FOR ELECTRICAL MACHINES. Benjamin G. Lamme, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed June 2, 1905. The conductors are placed in layers having an uneven number of groups per layer, in longitudinal peripheral slots, the openings of which are centrally located and are narrower than the body portion thereof.



923,754.—ALTERNATING-CURRENT MOTOR.

923,673. DYNAMO-ELECTRIC MACHINE. Charles E. Lord, Norwood, Ohio, assignor to Allis-Chalmers Company. Filed May 17, 1906. Laminated field poles extend inwardly from the frame or casing, each of the poles having the laminæ arranged in groups forming ventilating passageways, and laminated means are provided for closing the passageways at the inner ends of the poles.

923,686. PROTECTIVE CONDUIT-HOLDER FOR ELECTRICAL CONNECTIONS. James F. McElroy, Albany, N. Y., assignor to Consolidated Car-Heating Company. Filed September 11, 1908. In an electric heater, a protective cap forms a space between itself and the end of the heater to enclose the wire connection, and serves to clamp the laterally inleading wire conduit to the heater.

923,699. WIRELESS TELEGRAPHY. George W. Pierce, Cambridge, Mass., assignor to Massachusetts Wireless Equipment Company, Boston, Mass. Filed October 17, 1906. Describes a tuning apparatus for wireless receiving stations.

923,700. RECTIFIER. George W. Pierce, Cambridge, Mass., assignor to Massachusetts Wireless Equipment Company. Filed February 20, 1907. An asymmetrically conductive solid in a derived circuit rectifies and distorts the alternating current therein.

923,753. ALTERNATING-CURRENT MOTOR. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed May 1, 1907. The stator winding comprises two groups of coils, one distributed over portions of the stator corresponding approximately to the pitch of the fractional-pitch rotor winding, and the other, distributed over the remaining portion, the commutator brushes being arranged symmetrically with respect to both groups of stator coils.

923,754. ALTERNATING-CURRENT MOTOR. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed July 15, 1907. Describes a method of operating an alternating-current motor of the commutator type, which consists in starting it as a repulsion motor with the armature directly short-circuited and including an inductive winding in the armature circuit when the motor has started.

923,774. ELECTROLYTIC CELL OR CONDENSER. Elmer E. F. Creighton, Schenectady, N. Y., assignor to General Electric Company. Original application filed July 9, 1906. Divided and this application filed September 18, 1907. Aluminum cups arranged one within another are spaced apart by an electrolyte, and are insulated by a body of oil surrounding them.

923,796. BLOCK-SIGNAL SYSTEM FOR ELECTRIC RAILWAYS. Malcolm E. Launbranch, Chicago, Ill., assignor to Western Electric Company. Filed December 14, 1905. A car entering a block operates signals at both ends of the block, and a car leaving the block restores the signaling apparatus to its normal position when the block is clear.

923,797. INCANDESCENT LAMP. Ralph McNeill, New York, N. Y. Filed March 19, 1908. An anchor for a stretched filament comprises an eye portion, and an extension is connected therewith adapted to yieldingly engage the interior of a tube.

923,800. TRACK CONSTRUCTION AND ELECTRIC SIGNALING AND CONTROLLING EQUIPMENT THEREOF. Guion Thompson, Milton, Conn., and Huntington W. Merchant, New York, N. Y. Filed February 27, 1905. A traveling bridging contact is adapted when moving in one direction to temporarily close a normally open contact, and when moving in the opposite direction to temporarily close another normally open contact.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired June 7, 1909:

476,236. ELECTROMAGNET. A. D. Ayres, Kalamazoo, Mich.

476,240. RAILWAY SIGNALING SYSTEM. F. P. Benjamin, New York, N. Y.

476,296. ELECTRIC BATTERY. R. P. Osgood, Methuen, Mass.

476,317. SYSTEM OF TESTING ELECTRIC CIRCUITS. C. H. Rudd. Chicago, Ill.

476,330. SAFETY DEVICE FOR ELECTRIC MOTORS. E. Thomson, Lynn, Mass.

476,331. DYNAMO-ELECTRIC MACHINE. E. Thomson, Lynn, Mass.

476,346. ALTERNATING-CURRENT MOTOR. M. J. Wightman, Lynn, Mass.

476,347. ELECTRIC MOTOR. D. H. Wilson, Chicago, Ill.

476,368. BRUSH-HOLDER FOR DYNAMO-ELECTRIC MACHINES AND MOTORS. F. B. Daggett, St. Joseph, Mo.

476,376. ELECTRICALLY-CONTROLLED VALVE. W. B. Fleming, Philadelphia, Pa.

476,426. ELECTRIC GENERATOR OR MOTOR. E. A. Sperry, Chicago, Ill.

476,437. ELECTRIC LOCOMOTIVE. T. E. Adams, Cleveland, Ohio.

476,483. SECONDARY-BATTERY PLATE. E. C. Paramore, Philadelphia, Pa.

476,490. SYSTEM OF TESTING FOR ELECTRIC CIRCUITS. C. H. Rudd, Evanston, Ill.

476,492. CIRCUIT FOR TEST-BATTERIES AND CORDS OF MULTIPLE SWITCHBOARDS. C. E. Scribner, Chicago, Ill.

476,493. ELECTRIC ARC LAMP. C. E. Scribner, Chicago, Ill.

476,494. KEYBOARD SYSTEM FOR METALLIC CIRCUITS. J. A. Seely, New York, N. Y.

476,59. KEYBOARD CIRCUIT FOR MULTIPLE SWITCHBOARDS. O. A. Bell, New York, N. Y.

476,527. SYSTEM OF ELECTRIC LIGHTING. T. A. Edison, Menlo Park, N. J.

476,528. INCANDESCENT ELECTRIC LAMP. T. A. Edison, Menlo Park, N. J.

476,529. SYSTEM OF ELECTRICAL DISTRIBUTION. T. A. Edison, Menlo Park, N. J.

476,530. INCANDESCENT ELECTRIC LAMP. T. A. Edison, Menlo Park, N. J.

476,531. ELECTRIC LIGHTING SYSTEM. T. A. Edison, Menlo Park, N. J.

476,618. APPARATUS AND SYSTEM FOR COMPOUND TELEGRAPHY AND TELEPHONY. F. W. Dunbar, Newark, N. J.